PHONOLOGICAL ORGANIZATION IN BILINGUALS: EVIDENCE FROM SPEECH ERROR DATA

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ABSTRACT.
Effects of bilingualism on phonological organization were examined by comparative analysis of over 1,500 elicited speech errors in late French/English bilinguals, 10 native speakers of each language. In comparison with (10) monolingual controls in French and English, some error categories were consistent with existing data, while significant differences in other categories previously considered "universal" were observed in all bilinguals.

1. INTRODUCTION

One aspect of bilingual speech which has not been investigated is the phonological organization of speech production. Speech errors are considered evidence of events at this level of phonological organization; speech error behavior has been taken into consideration in most current models of speech production (Fowler, 1987). Nearly a century of analysis of spontaneous, and more recently, elicited, speech errors in German, English, and Dutch have revealed regularities in certain characteristics of speech error behavior (reviewed in: Cutler, 1982). Speech errors of aphasics have also demonstrated the same, consistent pattern (Blumstein 1990).

Speech error behavior in bilinguals has not been investigated. As significant differences between the first and second languages of late bilinguals have been observed in many aspects of speech behavior, it was hypothesized that speech error analysis could reveal differences in the phonological organization of speech production between the first and second languages of late bilinguals. The prediction was that speech errors of bilinguals would not indicate independent behavior of segments unique to the second language, and that no error would violate the phonotactic constraints of the first language.

Initial results indicated significant differences between bilinguals in both languages and monolingual speakers of their first languages, as well as differences between the two monolingual groups. These differences were fully examined, for they included "violations" of characteristics previously considered universal in speech error behavior.

2. PROCEDURE

A speech-error elicitation task, modelled on one created by Shattuck-Hufnagel (1987), was designed to elicit speech errors from monolingual and bilingual speakers of French and English.

2.1 Subjects.

Four subject groups were chosen: (1) 10 monolingual French speakers; (2) 10 monolingual English speakers; (3) 10 native speakers of French, late bilinguals in English; (4) 10 native speakers of English, late bilinguals in French. Late bilinguals were chosen because of the evidence of significant

differences observed between early and late bilinguals in second language competence, performance, and cortical behavior (Vaid 1987). All bilingual subjects had lived in a country in which the second language was spoken for periods of more than one year, and at the time of testing used both languages daily. All rated themselves as fluent speakers of their second languages.

2.2 Method.

Forty word sets comprised of two monosyllabic and two disyllabic words were presented to subjects in each language. All words were consonant initial, and varied in syllable structure from CVC to CVCVC structure. 35 of the word sets had sound sequences which were possible in both languages, with segments which exist in both languages. Syllable structure was the same in the two sets. Examples:
English: parade fad foot parole;
French: parade fad foot parole.
The remaining five word sets were different in the two languages. These did not all have the same syllable structure. All sets included segments unique to each language in word-onset position.
Example: (Target segment: TH)
English: six thick thistle sticks.

Subjects were presented with index cards on which the four-word sets were printed. Subjects were instructed to read each card three times, then to set the card down and repeat the four-word set from memory three more times, for a total of six repetitions. To avoid a memory confound, subjects were instructed to refer to the card if necessary during the final three repetitions.

Monolingual subjects were recorded in a single session. Bilingual subjects were recorded in separate sessions for their two languages, at a minimum interval of three weeks, because of the similarity of the two stimulus sets.

2.3 Data Analysis.

All sessions were transcribed, and errors were classified in several ways. Counts were made of consonant, vowel, word order and blend errors. These were further classified as either exchange, replacement, intrusion, or deletion errors. Position in word for all errors was recorded.

For interaction errors, the substitutions and exchanges, in which both the target segment and the uttered segment involved in an error occur in the word string, the direction of the error (either anticipatory or perseveratory) and the relative position in word of the target and the uttered segment in the speech error were recorded. Stress was also noted, for both the target and uttered segments, as well as voicing and place of articulation.

For intrusion errors, in which the uttered segment in an error does not occur in the stimulus set, comparison was made between the target segment and the uttered segment for syllable structure, place of articulation, and rhyme. The number of segments replaced was recorded, and errors were examined for word formation.
All errors, both interactions and intrusions, which resulted in word formation were compared to target words for rhyme and syllable structure.

Data analysis included counts of all error types for each subject. For all groups, total counts, calucations of means and standard deviations were made for all error types. Between-group comparisons were tested by ANOVA and Chi Square analysis.

3. RESULTS.

Four main trends were observed:
1. Similarities between groups.
2. Significant differences between French and English monolinguals.
3. Effect of second language acquisition on error type, size and position, on both first and second languages of bilinguals.
4. Language-specific differences in segment repertoire.

3.1. Similarities between groups.

Several speech error categories were similar in all groups, and consistent with existing data. For these error types, significant differences were not observed either between or within subject groups. The categories for which this occurred were: (1) the ratio of anticipatory to perseveratory errors; (2) position effect -- the ratio of interaction of segments sharing word position to those in different word position (initial/initial to initial/medial, etc.); (3) stress effect -- the ratio of interacting segments bearing similiar lexical stress to those bearing different lexical stress; (4) the percentages of total errors for each group that were: anticipatory, perseveratory, exchange, replacement, and word order errors.

3.2. Significant differences in error patterns for French and English monolinguals.

Unlike monolingual English speakers, who have demonstrated a clear bias towards word-initial position errors, monolingual French speakers made a large percentage of their errors (up to 60%) in word-final position. Two rules affect consonants in word-final position in French: (1) final consonant deletion; (2) for coronals only, variability in production -- word-final coronals are produced only if adjacent word is vowel-initial. These phonological properties of word-final consonants in French may influence this effect, as word-final errors in monolingual French speakers occur almost exclusively on coronals.

3.3. Effect of second language acquisition on error position, size and type in both first and second languages of bilinguals.

Several characteristics of errors produced by bilinguals in their first and second languages were significantly different from those of the monolingual control groups. These differences included: error position, size and type.

Error position.

Bilingual native speakers of English produced up to 30% of their errors, in both French and English, in word-final position. These errors were not dominated by coronals in word-final position. Like the errors of bilingual English speakers, word-final errors of French bilinguals were neither restricted to, nor dominated by, coronal consonants, in either French or English. These results indicate either interactive effects between the first and second languages, or an effect of bilingualism which creates an unrestricted bias toward word-final errors.

Error unit.

While errors of monolingual speakers involved units which varied from 1 to 5 segments, almost all errors by bilinguals involved single segments only. The only errors of bilinguals which involved units greater than a single segment were "blend" errors, a combination of syllables from two words in the stimulus set, in the first language.

Error type.

a. Blend. Although "blend" errors were made by almost all monolingual speakers, very few blends were made by bilinguals, and all in their first languages. No "blend" errors occured in the second language of bilinguals. All L2 errors were restricted to single segments.

b. Deletion. No deletions were made by monolingual speakers. Deletion errors were made only by bilinguals, only in French, and only on word-final consonants.

c. Intrusion.

Size. Intrusion errors made by monolinguals ranged from 1-5 segments in size. Bilingual intrusion errors were restricted to single segments.

Word Formation. 93% of monolingual intrusion errors resulted in word formation. Words were formed by bilingual intrusion errors only in L1 (the native language).

Rhyme. 82.5% of English monolingual and 90% of French monolingual intrusion errors created rhymes with target words. Bilingual intrusion errors did not create words which rhymed with the targets.

3.4. Language-Specific Differences in Segment Repertoire.

No errors of any type were made by any bilingual speaker in which a segment which was unique to the second language occurred as a substitution for any other target.

4. DISCUSSION.

The fact that some categories of errors occured with similar frequency in all groups, corresponding to existing data on speech error behavior, may indicate that these aspects of speech error behavior are more "language-universal" than other categories. The differences, however, indicate that "universals" must be tested in more language populations, and speaker types (bilingual and monolingual) before they can truly be classified as invariable.

Monolinguals.

The difference in dominant error position between French and English monolinguals is interpreted as consistent with existing data. Because of the restriction of word-final errors to coronal consonants, these errors may be considered word-initial, as word-final coronals, when produced, resyllabify as onset consonants of adjacent vowel-initial words.

Bilinguals.

The differences in speech error behavior between bilingual and monolingual speakers indicate that second language acquisition in French/English bilinguals affects the phonological organization of speech production planning in both their first and second languages. The elements affected are: error position, size, and type. The characteristics of the word-final errors of both bilingual groups could be explained by interaction of the two phonologies. The other changes, error size and type, are more difficult to explain, and demand further investigation. Since the "mobility" of a segment, its occurence as a substitution for another segment in positions or words other than its target position, is considered evidence of "independent" behavior, it might be concluded that L2-only segments do not function independently. The need to process these segments may bring about a more "holistic" processing of second language words in which they occur. There is abundant evidence of right hemisphere particpation in the processing of second language speech of bilinguals, which may involve a more holistic functions (reviewed in Fabbro et al. 1990). Further study of other bilingual populations is indicated to further explore the "universality" issue, and the effects of bilingualism.

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