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DO DISTINCTIVE FEATURES PLAY A ROLE IN SPEECH ERRORS? EVIDENCE FROM ENGLISH

This paper examines phonological speech errors through the lens of distinctive feature theory, addressing two central questions: whether distinctive features operate independently or interdependently, and how frequently speech errors involve single-feature consonant substitutions. The analysis demonstrates that feature dependency varies according to the theoretical framework applied. Drawing on 100 consonant speech errors extracted from *the Fromkin Speech Error Database*, nearly 50% involve phonemes differing by only one distinctive feature. These findings confirm the relevance of distinctive features in speech production research and establish a methodological foundation for future investigations extending the analysis to vowels and typologically diverse languages.

Keywords: speech error, phoneme, distinctive feature, English

1. Introduction

The notion of distinctive features of phonemes was introduced into phonological theory by Roman Jakobson as early as 1941 (see, e.g. Mannell 2008 for further details). Delimitation of phonemes as “bundles of simultaneously produced distinctive features” (Jakobson and Halle 1956: 59) indicates that not a phoneme but a distinctive feature is the crucial element in phonological ana-

lysis. In Jakobson's theory, features depend on the articulatory and acoustic properties of speech sounds (Jakobson and Halle 1956: 32). Subsequently, various distinctive feature theories were introduced by different authors emphasizing the importance of the phonetic nature of sounds in their phonemic delimitation (see, e.g. Hall 2007 for the summary of the issue). Later some linguists left out acoustic properties of sounds from the description of their distinctive features (e.g. Chomsky and Halle 1968), and some researchers criticize distinctive features completely (e.g. Wilson 1966).

Nevertheless, distinctive features of phonemes have gained their solid position in phonology and are considered central for specification of a phoneme and classes of phonemes, for the delimitation of rules of numerous sound changes in speech and for the description of some speech errors (Eulenberg and Farhad 2011).

Considering speech errors, much has been written about the possible application of distinctive features in the analysis of several phonetic/phonemic errors in children and/or adults (see, e.g. Pollack and Rees 1972 or Parker 1976 for further details). Diverse research results indicate not only the feasible role of features in speech errors mechanism (e.g. Eulenberg and Farhad 2011), but also possible limitations of such an approach (e.g. Pollack and Rees 1972). Victoria Fromkin – a leading personality in the field of psycholinguistic approach to speech errors – in the analysis and interpretation of the data from the corpus of more than 600 speech errors collected by herself (Fromkin 1973) indicates that “units smaller than the segments, i. e. properties or features of speech sounds, are ‘perceived’ and confused” (ibid. 223). Consider, for example, the pronunciation *mang the mail* instead of the intended *bang the nail* in (1):

(1) bang the nail /bæŋ ðə neɪl/ → mang the mail /mæŋ ðə meɪl/

The only difference between /b/ and /m/ in (1) is nasality: /b/ is [-nasal], /m/ is [+nasal], “all other features remaining the same” (ibid.: 264). In this case, the speech error is based on the substitution of a single feature (ibid.). Although in her analysis, there are more examples of this type, Fromkin states that “[i]t is certainly true that errors which involve a substitution of features are rare, compared to errors involving larger units.” (ibid.: 225) and indicates that “[...] we are unable to conclude that individual features are independently involved in all cases” (ibid.: 225). Taking the complexity of the relationship between phonetic properties of sounds and their distinctive features into account, the author suggests that certain distinctive features strongly depend on the existence of other characteristics of the sound. For example, “a simple switch of the feature [+coronal], [...], without other phonetic effects” (ibid.: 227) is not possible. Thus, despite several examples showing the change of one feature only, Fromkin seemed to be sceptical about the involvement of individual features in various

speech errors and preferred changes at the level of a segment (see Fromkin 1973 for more details).

Quotations above imply two reasons why it is not possible to admit that not only a phoneme but also a distinctive feature can be the object of misapplication in speech: (1) negligible occurrence of such cases and (2) mutual dependency of features.

Levelt (1993) in his popular step-by-step account of the entire process of speech production too casts doubt on the possibility to misuse a distinctive feature of a phoneme and not the whole phoneme while speaking stating that „[t]he only really clear cases of feature replacements, i.e., where new phonemes are formed, occur with negligible frequency; only a few cases have been reported in the literature” (ibid.: 341). However, a few pages later, when depicting segmental errors, the author gives evidence about “the feature-similarity constraint in experimentally elicited errors” (ibid.: 350) meaning that, as to segmental errors, the intended phoneme and the pronounced phoneme “tend to be similar in distinctive feature composition” (ibid.).

Consequently, thinking of speech errors and phonemes and their distinctive features, two questions arise:

(1) Are distinctive features of phonemes independent or is there a kind of mutual dependency between at least some of them as mentioned by Fromkin (1973)?

(2) Do feature-replacement based speech errors have so trivial frequency of occurrence that one can hardly accept the existence of speech errors resulting from the wrong activation of distinctive feature only as stated by Fromkin (1973) and Levelt (1993) two decades after?

We will try to find answers to those questions in the following lines of our paper. In section 2, we will concisely present the relevant facts from the original distinctive feature theory as introduced by Jakobson to answer the question (1). This is followed by a more modern version of this theory (Sabol 1989), which provides the distinctive feature delimitation of English consonant phonemes¹ required for our analysis. Section 3 briefly introduces speech errors. The results of our analysis can be found in 4.1. and part 5 offers concluding remarks.

2. Distinctive features – autonomous or dependent?

The answer to the question (1) depends on the theory chosen. In other words, the acceptance of the autonomous or dependent character of distinctive features is given by the extent to which the applied distinctive feature theory aligns with the original Jakobson’s view of features as autonomous units in (2):

¹ This is the first step of our research in which we concentrate on consonant speech errors only.

standard British English consonants as specified by Jakobson et al. (1963) is captured in Table 1.

Looking at the inventory of the consonant phonemes in Table 1, we can see that eight distinctive features out of the set of twelve describe the consonant phonemes in British English (Received Pronunciation). In addition, Table 1 shows that two phonemes are omitted, /r/ and /w/. To complete the feature specification of English consonant phonemes in terms of distinctive features that are not hierarchically dependent, we had to rely on a feature theory that treats distinctive features as autonomous units and adheres as closely as possible to Jakobson's original framework. Although it does not represent the most recent theoretical model, Sabol's theory (1989) best meets these criteria and was therefore adopted for the purposes of the present study, as specified below.

Table 1. Phoneme specification of standard British English consonants by Jakobson's distinctive features (based on Jakobson et al. 1963: 43)³

	l	ŋ	f	ʃ	k	ʒ	dʒ	g	m	f	p	v	b	n	s	θ	t	z	ð	d	h	j
vocalic/non-vocalic	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
consonantal/non-consonantal	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-
interrupted/continuant			+	-	-	+	-	-		+	-	+	-		+	+	-	+	+	-		
strident/mellow				+	+		+	-							+	-		+	-			
voiced/unvoiced	+	+	-	-	-	+	+	+	+	-	-	+	-	+	-	-	-	+	+	+	+	+
compact/diffuse		+	+	+	+	+	+		-	-	-	-	-	-	-	-	-	-	-			
grave/acute								+	+	+	+	+	-	-	-	-	-	-	-			
tense/lax			+	+	+	-	-	-		+	+	-	-		+	+	+	-	-	-	+	-
nasal/oral		+	-	-	-	-	-	-	+	-	-	-	-	+	-	-	-	-	-	-		

³ Empty box means that the phoneme is not specified by a particular distinctive feature.

2.2. Sabol's distinctive feature theory and specification of English consonant phonemes

Sabol's theory of distinctive features of phonemes is inspired by the aforementioned influential work of Jakobson and Halle (1956). This means that features are delimited in agreement with articulatory, acoustic and perceptual correlates of phonemes. Nevertheless, keeping the different functions of sounds in mind, Sabol – contrary to the original theory – delimits a different set of features for vowels and a different set for consonants. As to consonants, they too are divided into two categories depending on their acoustic properties: sonorants (their spectral structure is characterized by tone, similar to vowels) and obstruents (sounds whose acoustic structure is characterized by noise) (Sabol 1989: 73-74). The feature specification of English sonorants and obstruents on the basis of Sabol's theory can be found in Table 2 and Table 3, respectively.⁴

Table 2. Feature specification of English sonorants in terms of Sabol's theory

	l	r	w	j	m	n	ŋ
vocalic/non-vocalic	+	+	+	+	+	+	+
consonantal/non-consonantal	+	+	+	+	+	+	+
diffuse/non-diffuse	+	+	+	-	+	+	-
acute/non-acute	+	+	-	+	-	+	-
lateral/non-lateral	+	-	-	-	-	-	-
nasal/oral	-	-	-	-	+	+	+

Table 3. Feature specification of English obstruents in terms of Sabol's theory

	p	b	f	v	ð	θ	t	d	s	z	ʃ	ʒ	tʃ	dʒ	k	g	h
vocalic/non-vocalic	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
consonantal/non-consonantal	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
diffuse/non-diffuse	+	+	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-
acute/non-acute	-	-	-	-	-	-	+	+	+	+	+	+	+	+	-	-	-
occlusive/non-occlusive	+	+	-	-	-	-	+	+	-	-	-	-	+	+	+	+	-
sibilant/non-sibilant	-	-	-	-	-	-	-	-	+	+	+	+	+	+	-	-	-
voice/non-voice	-	+	-	+	+	-	-	+	-	+	-	+	-	+	-	+	-

⁴ Exhaustive delimitation of the individual distinctive features can be found in Sabol (1989).

Having specified all English consonant phonemes as bundles of simultaneously organized independent distinctive features, we can proceed to the core of our research – the analysis of speech errors.

3. Speech errors

Speech errors, the discrepancies between what we plan to say and what we say, also known as slips of the tongue, “reflect something important about how speech is planned and produced” (Cowles 2011: 162). Speech errors are not random and occur in systematic patterns and that is why psycholinguists use them to learn more about the speech production process (Traxler 2012: 43).

For the purposes of classifying speech errors, the present study adopts the framework proposed by Harley (2006: 739), who distinguishes two criteria. The first criterion concerns the linguistic unit affected by the error. As illustrated in (3), the unit involved may be a word (3a), a morpheme or phoneme (3b), or a distinctive feature (3c).

- (3) a. pass the **pepper** → pass the salt
- b. flock of **bats** → **block** of **flats**
- c. turn the knob /nɒp/ → /nɒb/ (ibid.: 739)

The type of error mechanism is the second criterion. As shown in (4), the principal error mechanisms include anticipation (4a), exchange (4b), and substitution (4c).

- (4) a. the **m**irst of May → the **f**irst of May
- b. Guess whose **mind** came to **name**? → Guess whose **name** came to **mind**?
- c. Get me a **fork** → Get me a **knife** (ibid.)

Additional mechanisms documented in the literature comprise perseveration, in which an earlier element is repeated in a later position, and blends, in which two competing forms merge into a single erroneous output (see, e.g. Fromkin 1973 for detailed account).

It is generally accepted that speech errors occur not only in the utterances of individuals with various brain damage or hearing impairment, but are also frequently observed in speech of speakers with normal hearing and without any brain injury. Their causes are varied and may include nervousness, tiredness, lack of concentration or, simply, discrepancies between speech and thinking (see, e.g. Harley 2006 for more details).

4. Research material

The material point of departure for our analysis was the corpus of 100 speech errors gained from the website Speech Error Database provided by Max Planck Institute for Psycholinguistics (https://www.mpi.nl/dbmpi/sedb/sperco_form4.pl). This database, officially called *The Fromkin Speech Error Database*, represents a significant resource for psycholinguistic research, comprising speech error data collected over several decades. The dataset was originally digitised at the University of California, Los Angeles (UCLA). Following Professor Fromkin's death in January 2000, the database underwent conversion to XML format as part of a collaborative preservation initiative sponsored by the Max Planck Society. The database encompasses nine corpora drawing on data from four languages – English, French, German, and Italian – and provides researchers with the ability to filter errors according to multiple linguistic parameters, including error type, process type, prosodic domain, syllabic position, and stress domain. This multi-dimensional filtering functionality makes the database a particularly versatile instrument for psycholinguistic inquiry (<https://www.mpi.nl/page/mpi-archives-databases>). For the purposes of the present study, the corpus UCLASEC.ENGLISH.FROMKIN was selected without sub-corpus specification, with the analysis restricted to phonological errors only.⁵ The search parameters applied are illustrated in Figure 1.

The screenshot shows the 'Speech Error Database Search Engine' interface. At the top, it says 'Max Planck Institute for Psycholinguistics' and 'Home'. The main title is 'Speech Error Database Search Engine'. Below this are several filter sections:

- Corpus:** UCLASEC.ENGLISH.FROMKIN (dropdown)
- Sub corpus:** All (dropdown)
- Target language:** ENGLISH (dropdown)
- Speaker:** (empty text field)
- Error type:** PHONOLOGICAL (dropdown)
- Process procedure:** All (dropdown)
- Process direction:** All (dropdown)
- Corrected:** All (dropdown)
- Domain Properties:**
 - Syntactic domain:** All (dropdown)
 - Prosodic domain:** All (dropdown)
 - Stress domain:** All (dropdown)
 - Word domain:** All (dropdown)
 - Syllabic domain:** All (dropdown)

At the bottom, there are 'Clear fields' and 'Search >>' buttons.

Table 1: Impoliteness type (Feng and Ren 2020)

⁵ It should be noted that in the present study, the speech error data drawn from the Fromkin database reflect productions by native speakers of English. English functions here as the speakers' first language (L1), which is a relevant factor to bear in mind when interpreting the results and considering their potential cross-linguistic implications.

4.1. Analysis

Set parameters provided us with more than 1000 various phonological speech errors. Keeping in mind the aim of our research, we concentrated on those phonological speech errors that are further classified as “*segment substitution*”. For example, error N. 328, target utterance: *and yeah it looks really good*, error utterance: *and yeah it **Rooks** looks really good* is accompanied with the information “target unit [l-], error unit [r-]”, so it has been included in our analysis since it is the error affecting one segment only. However, error N. 321, target utterance: *and now that's I'm finishing I want to thank all the speakers*, error utterance: *....I want to SPANK all the THINKers* with the additional information “target unit: #[T-] #[sp-], error unit: #[sp-] #[T-...-n-] “ was not the part of our analysis. Obviously, it is an error touching more than one segment.

Consequently, we have excerpted the sample of 100 speech errors based on the substitution of one segment and analysed them in terms of the distinctive features of consonant phonemes involved to find out the frequency of the occurrence of errors affecting distinctive features only.

4.2. Results

In our sample, 100 tokens of one-segment speech errors represent 64 distinct error types. Of these, 50 types (78%) involve speech errors in which the phonemes participating in the given phonological error mechanism differ in two or more distinctive features, as can be seen in (5)-(7) with target utterance on the left side and the error utterance on the right side.

(5) j – l (distinctive features diffuse, lateral)

he looks twenty years younger → *he looks twenty years lunger*
/ 'hi: 'ləks 'twenti 'jiəz 'jʌŋgə/ / 'hi: 'ləks 'twenti 'jiəz 'lʌŋgə/

(6) s – d (distinctive features occlusive, sibilant, voice)

to smoke such large cigars → *to smoke such large digarz*
/ tʊ 'sməʊk sʌtʃ 'lɑ:dʒ sɪ'gɑ:z/ / tʊ 'sməʊk sʌtʃ 'lɑ:dʒ dɪ'gɑ:z/

(7) dʒ – p/p – dʒ (distinctive features diffuse, acute, sibilant, voice)

jiggery pokery → *piggery jokery*
/dʒɪgəri 'pəʊkəri/ /pɪgəri 'dʒəʊkəri/

14 types (specified in Table 4), that is 22%, are based on the substitution of a single distinctive feature only. This substitution results in the replacement of one phoneme, possessing the given feature, with another phoneme characterised

by the absence of that distinctive feature, as illustrated by examples (8)-(12), or vice versa, as exemplified by (13) and (14).

(8) g – k (distinctive feature voice)

between the gloria and the credo → *between the cloria and the credo*
/bɪ'twi:n ðə 'glɔ:riə ən ðə 'kri:dəʊ/ → /bɪ'twi:n ðə 'klɔ:riə ən ðə 'kri:dəʊ/

(9) tʃ – ʃ (distinctive feature occlusive)

if there is a Swiss watch company → *if there is a Swiss wash company*
/ɪf ðə z ə swɪs 'wɒtʃ 'kʌmpəni/ → /ɪf ðə z ə swɪs 'wɒʃ 'kʌmpəni/

(10) l – r (distinctive feature lateral)

problems that are plaguing other schools → *problems that are*
praguig other schools
/'prɒbləmz ðæt ə 'pleɪɪŋ 'ʌðə sku:lz/ → /'prɒbləmz ðæt ə 'preɪɪŋ
'ʌðə sku:lz/

(11) p – k (distinctive feature diffuse)

beatrice potter country → *beatrice kotter country*
/'bi:tri:ks 'pɒtə 'kʌntri/ → /'bi:tri:ks 'kɒtə 'kʌntri/

(12) n – m (distinctive feature acute)

things that are seen as similar → *things that are seem as similar*
/'θɪŋz ðæt ə 'si:n əz 'sɪmələ/ → /'θɪŋz ðæt ə 'si:m əz 'sɪmələ/

(13) m – w/w – m (distinctive feature nasal)

that Edwards was mobbed → *that Edwards was wobbled*
/ðæt 'edwədz wəz mɒbd/ → /ðæt 'edwədz məz wɒbd/

(14) f – v (distinctive feature voice)

must be defined → *must be devined*
/məst bɪ dɪ'faɪnd/ → /məst bɪ dɪ'vaɪnd/

Those 14 types (22%) of segment substitutions between segments differing by only one distinctive feature (cf. Tables 2, 3, and 4) represent 49 individual instances in our sample, accounting for 49% of all cases.

Fromkin (1973) and Levelt (1993), when refuting the possibility that speech errors may affect only the distinctive features of phonemes rather than whole phonemes, argue, as quoted above, that cases of feature replacement are very infrequent. Nevertheless, as our analysis demonstrates, feature speech errors account for 49% of individual occurrences and 22% when error types are taken into account. Although the present sample is limited in size, these findings

Table 4. Types of distinctive feature substitutions

substituted segments	number of occurrences	distinctive feature differing them
r – l	11x	lateral
s – ʃ	6x	diffuse
p – k/k – p	5x	diffuse
t – p/p – t	5x	acute
f – p	4x	occlusive
m – w/ w – m	4x	nasal
f – v/v – f	3x	voice
n – m/m – n	3x	acute
z – d	2x	occlusive
t – d	2x	voice
k – g	1x	voice
ʧ – ʃ	1x	occlusive
b – d	1x	acute
r – j	1x	diffuse

provide preliminary evidence confirming the existence of speech errors that affect distinctive features only, suggesting that such errors, however infrequent, constitute a genuine phenomenon deserving of further investigation.

Figure 2 shows proportions of individual distinctive features in our sample of distinctive feature substitutions.

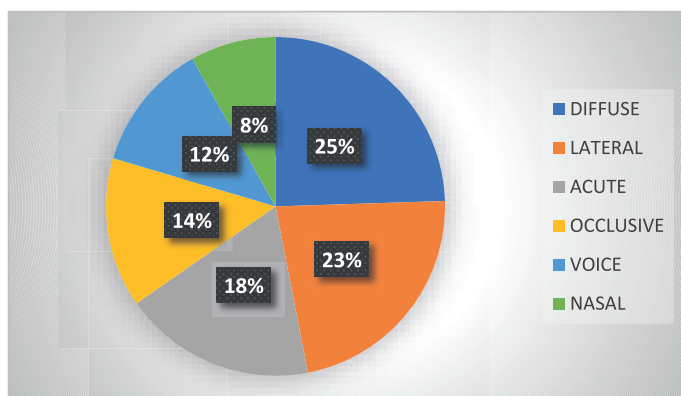


Figure 1. Specification of Parameters in Speech Error Database
(https://www.mpi.nl/dbmpi/sedb/sperco_form4.pl)

The results of segment substitutions between phonemes differing by only one distinctive feature, presented in Figure 2, indicate that the feature *diffuse* occurs most frequently in our sample. This is not in line with our initial expectation that the feature *voice* represents one of the fundamental distinctions between consonant sounds across languages. The distinctive feature *lateral* ranks as the second most frequent. In speech production, it is typically the feature lateral that is “wrongly activated” (using Levelt’s terminology). This feature differentiates exclusively between two phonemes, /r/ and /l/. It appears that the lateral – non-lateral opposition presents difficulties not only in English but, as our preliminary results based on the analysis of speech errors in Slovak suggest, in other languages as well. The remaining distinctive features – *acute*, *occlusive*, *voice*, and *nasal* – occur with gradually decreasing frequency. The size of our sample may be considered a limitation with respect to the interpretation of these results. Accordingly, these observations may be elaborated upon in greater detail in follow-up research.

5. Conclusions

With regard to speech errors and their possible distinctive-feature nature, the literature offers various standpoints. Some authors (e.g. Frisch and Wright 2002 or Eulenberg and Farhad 2011) acknowledge the role of distinctive features in speech errors. Another group of scholars (e.g. Fromkin 1973 or Levelt 1993) maintains that a speech error cannot be based on the change of a single feature only. Two arguments are put forward in support of this view: (1) the mutual dependency of distinctive features, and (2) the very rare occurrence of such changes. We demonstrate that, concerning “feature dependency”, this relies on the distinctive feature theory adopted. The original distinctive feature theory proposed by Jakobson (Jakobson and Halle 1956), as well as the theories of their followers (Sabol 1989), treats distinctive features as autonomous, independent elements participating in the formation of a phoneme. As for the second argument against feature-based speech errors – (2) the alleged rare occurrence – our preliminary results based on the analysis of 100 consonant speech errors have shown that nearly half of the speech errors in our sample are based solely on the substitution of a single distinctive feature. This finding provides empirical support to the existence of feature-based speech errors as a genuine (psycho)linguistic phenomenon. Our results are thus consistent with Frisch and Wright’s (2002: 140) observation that the misordered portions in speech errors correspond to abstract linguistic units such as onsets, codas, phonemes, segments, and features. This claim, in light of our data, we take as further confirmation that distinctive features may indeed function as independent units sensitive to error in speech production.

Finally, future research, as indicated above, will need to extend the sample of speech errors analysed, incorporate vowel changes into the analysis, and include a greater number of languages in order to obtain data of potential cross-linguistic value.

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