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What Consonant Clusters Are Possible?

1. Introduction. Phonotactics is the study of the positions occupied by phonological units relative to one another. Thus, it is the component of phonology most nearly concerned with making predictions, that is, with generative description. A great deal of attention has consequently been given both to general questions of phonotactics¹ and to descriptions of particular languages.²

Many such accounts have dealt specifically with the role of distribution in defining phonological units, as opposed to definition by their constitution. For example, the question may be asked whether English /s/ is best defined as a unit that can occur initially in a syllable onset before /k, p, t/, or as a unit composed of the features [obstruent, continuant, anterior, coronal, sibilant]. Although this is a pseudo-question, much like asking whether nouns should be defined by function or by form, the history of linguistics is full of pseudo-questions that can be recognized as such only after efforts have been made to answer them.

¹ E. Benveniste, "Répartition des consonnes et phonologie du mot," in *Études phonologiques dédiées à la mémoire de M. le prince N. S. Trubetzkoy* (rpt. University, Ala.: Univ. of Alabama Press, 1964), pp. 27–35. Zellig S. Harris, *Methods in Structural Linguistics* (rpt. Chicago: Univ. of Chicago Press, 1951), pp. 150–55. Eli Fischer-Jørgensen, "On the Definition of Phoneme Categories on a Distributional Basis," *Acta Linguistica Hafniensia*, VII (1952), 8–39. Hans Vogt, "Phoneme Classes and Phoneme Classification," *Word*, X (1954), 28–34. Bengt Sigurd, "Rank Order of Consonants Established by Distributional Criteria," *Studia Linguistica*, IX (1955), 8–20. Charles F. Hockett, *A Manual of Phonology*, Indiana University Publications in Anthropology and Linguistics, memoir 11; *IJAL*, XXI, no. 4, pt. 1 (Baltimore: Waverly, 1955), pp. 91–95, 150–54. Frank Harary and Herbert H. Paper, "Toward a General Calculus of Phonemic Distribution," *Language*, XXX (1957), 143–69. N. S. Trubetzkoy, *Principles of Phonology*, trans. by Christiane A. M. Baltaxe (Berkeley: Univ. of California Press, 1969), pp. 242–55. Fred W. Householder, "The Distributional Determination of English Phonemes," *Lingua*, XI (1962), 186–91. Robert J. Scholes, *Phonotactic Grammaticality*, *Janua Linguarum*, series minor 50 (The Hague: Mouton, 1966).

² For example: Einar Haugen, "The Phonemics of Modern Icelandic," *Language*, XXXIV (1958), 55–88, here 76–86. Sol Saporta and Heles Contreras, *A Phonological Grammar of Spanish* (Seattle: Univ. of Washington Press, 1962). Diana L. Kao, *Structure of the Syllable in Cantonese*, *Janua Linguarum*, series practica 78 (The Hague: Mouton, 1971).

The principal concern of phonotactics, however, is the distribution of phonemes, in whatever way they are defined. One aspect of English that has received a good deal of attention is the permissible sequence in which consonants can follow one another, either after or before a pause.³ Because this aspect of English has been so much studied, it can be taken as a test case to evaluate the accomplishments, procedures, and assumptions of phonotactic study. A remarkable fact about such distributional studies is the extent to which they disagree with one another. There is, as one would expect, a core of agreement, but it is small, and there are more discrepancies than one might have predicted among sixteen typical studies.⁴

³ The terms COMBINATION, SEQUENCE, and CLUSTER are used interchangeably here for a group of tautosyllabic consonants. For a proposal to discriminate among them, see E. Pulgram, "Consonant Cluster, Consonant Sequence, and the Syllable," *Phonetica*, XIII (1965), 76–81.

⁴ Leonard Bloomfield, *Language* (New York: Holt, 1933), pp. 131–34; cf. James W. Abel, "Bloomfield's Final Clusters," *Quarterly Journal of Speech*, XLVI (1960), 111–14. Bohumil Trnka, *A Phonological Analysis of Present-Day Standard English*, rev. ed. (University, Ala.: Univ. of Alabama Press, 1968). Benjamin Lee Whorf, "Linguistics as an Exact Science," *Technology Review*, XLIII (December 1940), 61–63, 80–83; rpt. in *Language, Thought, and Reality*, ed. by John B. Carroll (Cambridge: Technology Press of MIT, 1956), pp. 220–32. Bernard Bloch and George L. Trager, *Outline of Linguistic Analysis* (Baltimore, Linguistic Society of America, 1942), pp. 48–49. Charles C. Fries, *Teaching and Learning English as a Foreign Language*, Publications of the English Language Institute, I (Ann Arbor: Univ. of Michigan Press, 1945), pp. 17–20. George L. Trager and Henry Lee Smith, Jr., *An Outline of English Structure*, Studies in Linguistics Occasional Papers 3, 1951 (rpt. Washington: ACLS, 1957), p. 35. J. D. O'Connor and J. L. M. Trim, "Vowel, Consonant, and Syllable—A Phonological Definition," *Word*, IX (1953), 103–22. Lawrence Gaylord Jones, "English Consonantal Distribution," in *For Roman Jakobson*, ed. by Morris Halle, Horace G. Lunt, Hugh McLean, and Cornelius H. Van Schooneveld (The Hague: Mouton, 1956), pp. 245–53. Kemp Malone, "The Phonemes of Current English," in *Studies in Heroic Legend and in Current Speech*, ed. by Stéfán Einarsson and Norman E. Eliason (Copenhagen: Rosenkilde and Bagger, 1957), pp. 226–67. Archibald A. Hill, *Introduction to Linguistic Structures* (New York: Harcourt, 1958), pp. 68–88. Eva Sivertsen, "Segment Inventories for Speech Synthesis," *Language and Speech*, IV (1961), 27–90. Yao Shen, *English Phonetics* (Ann Arbor: Univ. of Michigan, 1962), pp. 151–59. Lee S. Hultzén, "Consonant Clusters in English," *American Speech*, XL (1965), 5–19. A. Hood Roberts, *A Statistical Linguistic Analysis of American English*, *Janua Linguarum, series practica* 8 (The Hague: Mouton, 1965). F. G. Cassidy, "A Descriptive Approach to the Lexicon," in *Approaches in Linguistic Methodology*, ed. by Irmengard Rauch and Charles T. Scott (Madison: Univ. of Wisconsin Press, 1967), pp. 9–15, here pp. 12–14. Henry M. Moser, *One-Syllable Words* (Columbus, Ohio: Merrill, 1969). Other studies of English phonotactics that were not collated, but that are unlikely to affect the over-all results significantly are: J. R. Firth, "The Use and Distribution of Certain English Sounds: Phonetics from a Functional Point of View," *English Studies*, XVII (1935), 8–18; rpt. in *Papers in Linguistics, 1934–1951* (London: Oxford Univ. Press, 1957), pp. 34–46. Kemp Malone, "The Phonemic Structure of English Monosyllables," *American Speech*, XI (1936), 205–18. Etsko Krusinga, *The Phonetic Structure of English Words*, *Bibliotheca Anglicana* 2

The sixteen collated studies list a total of 107 possible onset clusters, of which there is agreement on only 30, considerably fewer than a third, leaving 77 onset clusters that are rejected by one or more studies. The 30 clusters that are universally recognized, with an example of each, are /bl/ *blue*, /br-/ *bread*, /dr-/ *draw*, /dw-/ *dwelling*, /ft-/ *flaw*, /fr-/ *free*, /gl-/ *glow*, /gr-/ *grow*, /kl-/ *claw*, /kr-/ *crow*, /kw-/ *quick*, /pl-/ *play*, /pr-/ *pray*, /sk-/ *sky*, /skr-/ *scrub*, /skw-/ *squall*, /sl-/ *sled*, /sm-/ *small*, /sn-/ *snow*, /sp-/ *speech*, /spl-/ *split*, /spr-/ *spray*, /st-/ *stay*, /str-/ *straw*, /sw-/ *sway*, /ʃr-/ *shred*, /tr-/ *tree*, /tw-/ *twig*, /θr-/ *throw*, /θw-/ *thwack*.

The discrepancy is even more striking for coda clusters. The same studies explicitly list or imply well over 500 clusters that are theoretically possible in syllable codas, of which there is agreement on only 19, fewer than 4 percent.⁵ The 19 final clusters that appear in all studies that deal with codas (three do not) are /-dz/ *adze*, /-ft/ *soft*, /-ks/ *fix*, /-lb/ *bulb*, /-lč/ *belch*, /-ld/ *build*, /-lf/ *gulf*, /-lk/ *silk*, /-lp/ *help*, /-lt/ *salt*, /-nč/ *punch*, /-nd/ *send*, /-nt/ *cent*, /-nz/ *bronze*, /-ps/ *lapse*, /-pt/ *apt*, /-sk/ *mask*, /-sp/ *clasp*, /-st/ *chest*. In addition there are 6 final clusters that were omitted from some single list or other, perhaps inadvertently, the complexities of final clusters being great enough to make error likely. These 6 are /-kt/ *act*, /-lm/ *film*, /-lv/ *valve*, /-mp/ *jump*, /-nj/ *change*, and /-ŋk/ *ink*.

If, as has been generally supposed, there are rules governing the permissible sequences of English sounds, so that some consonant clusters are possible in English whereas others are not, one might expect greater agreement on the facts than is apparent from the studies cited above. The wide-spread disagreement about the phonotactics of English raises questions about the concept "possible" and about the causes of the discrepancies among lists. The chief aim of the present study is to examine those questions, beginning with an analysis of the reasons for disagreement about English consonant clusters.

(Bern: Francke, 1942). Bent Nordhjem, *The Phonemes of English* (Copenhagen: Gad, 1960). Minoru Yasui, *Consonant Patterning in English* (Tokyo: Kenkyusha, 1962). Lee S. Hultzén, Joseph H. D. Allen, Jr., and Murray S. Miron, *Tables of Transitional Frequencies of English Phonemes* (Urbana: Univ. of Illinois Press, 1964). Hans Kurath, *A Phonology and Prosody of Modern English* (Heidelberg: Winter, 1964). Peter Sanderson, *English Consonant Clusters* (Oxford: Pergamon, 1966).

⁵ Betty Jane Wallace, "A Quantitative Analysis of Consonant Clusters in Present-Day English," dissertation, Univ. of Michigan, 1951, found that "the majority of initial clusters which can potentially occur in English were encountered in the recorded data [10,000 running words]. On the other hand, relatively few of the final clusters which can potentially occur in English appeared in the data," *Microfilm Abstracts*, XI (1951), 337. The difference in frequency doubtless partially explains why the studies are in greater agreement about onsets than codas.

2. Discrepancies of Method. Perhaps the most far-reaching, but also the most trivial, cause of differences between inventories of clusters is a discrepancy in the way the data has been observed, analyzed, or reported. Such a discrepancy is not in the data, but rather in the method of dealing with it.

The kind of phonological analysis that has been assumed can have a significant bearing on the list of consonant clusters that are recognized. For example, *use* can be analyzed as beginning with either a consonant or a vowel. The first analysis will produce several consonant clusters that will be nonexistent under the second analysis: /by-/ *bugle*, /fy-/ *few*, /hy-/ *hue*, /ky-/ *cue*, /my-/ *mute*, /py-/ *pupil*, /sky-/ *skew*, /spy-/ *spume*, /vy-/ *view*. The distinction between, for example, /fyuw/ and /fiu/ is likely to be a difference not in the data, but only in how the data is accounted for. The presence or absence on a list of such clusters as those above tells, therefore, more about the analysis than it does about the language.

Because voicing is nondistinctive in the environment /#s—V/, for example *spa*, more than one analysis of obstruents in that environment is possible: /sp-, sb-, sP-/ , in the last of which /P/ represents an archiphoneme. The /sb-/ analysis is preferred by Hultzén and the /sP-/ analysis by Twaddell.⁶

The analysis of the affricates as /č, ʝ/ or /tš, dž/ or /ty, dy/ will obviously have a bearing on phonotactics, as will the possible analysis of /š, ž/ as /sy, zy/. So too, the question of the onset of *which* (in dialects where it is not homophonous with *witch*) as monosegmental /^h/ versus bisegmental /hw/ may be extended to the treatment of voiceless obstruents like /t/ and /s/ as sequences, i.e. /hd/ and /hz/, with obvious consequences for phonotactic statements. The amount of such "reanalysis" that is possible is very great but essentially trivial.

Postvocalic /-r/ offers a problem in analysis. On the grounds that /r/ is a semivowel or a feature of rhotacism on the preceding vowel, some lists automatically exclude codas such as /-rb/ *curb*, /-rč/ *arch*, /-rd/ *beard*, /-rf/ *scarf*, /-rg/ *morgue*, /-rj/ *merge*, /-rk/ *mark*, /-rl/ *curl*, /-rm/ *storm*, /-rn/ *earn*, /-rp/ *harp*, /-rs/ *force*, /-rš/ *marsh*, /-ršt/ *borscht*, /-rt/ *part*, /-rθ/ *north*, and /-rv/ *curve*. Dialect variation is also relevant to the question of whether one records final clusters with postvocalic /-r/.

Some lists recognize final clusters with postvocalic /-w/ and /-y/: /-wb/ *robe*, /-wč/ *couch*, /-wd/ *crowd*, /-wf/ *loaf*, /-wg/ *rogue*, /-wʝ/ *scrooge*; /-yk/ *ache*, /-yl/ *oil*, /-ym/ *seem*, /-yp/ *ape*, /-yr/ *tire*, /-ys/ *rice*, and so on. The

⁶ Lee S. Hultzén, "Voiceless Lenis Stops in Prevocalic Clusters," *Word*, XVIII (1962), 307-12; cf. Leigh Lisker, *Word*, XIX (1963), 376-87. W. Freeman Twaddell, *On Defining the Phoneme*, Language Monographs 16 (Baltimore: Waverly, 1935), p. 49.

inventory of such clusters is very large because /-w/ and /-y/ occur before most, although not all, of the other clusters. If Trager-Smith postvocalic /-h/ is part of one's analysis and if that /-h/ is regarded as a consonant in defining clusters, another extensive list of clusters must be made, including, for example, /-hrlɔdz/ *worlds*. It is clear that the presence or absence of such clusters in an inventory tells nothing about the consonant sequences of English, but only something about the way vocalic nuclei have been analyzed.

Some clusters are reported perhaps because of quirks in the linguist's observation of the data. Bloomfield (p. 133) lists /-ðm/ in *rhythm* and /-zm/ in *chasm*, and by general rule implies /-ðmɔ, -ðmz, -zmd, -zmdz/. But the words in question are disyllables, and, as Kenyon noted some time ago, the consonant sequences in question do not occur, for the nasal in such words is immediately preceded by a vocalic segment: [rɪðəm, kæzəm].⁷ Sivertsen (p. 71) reports /ŋg-/ in the name *Ngami* on the authority of Daniel Jones; but the position of Jones's stress mark clearly indicates that the initial nasal is syllabic before /g/ and thus the two consonants are not an onset cluster.⁸

Most studies of English phonotactics have been concerned to find general rules governing the permissible sequences of sounds, for example, that geminate sounds may not occur in a cluster, that obstruents in the same cluster must agree in voicing, that the order in which consonants can occur in an onset cluster is (to some extent) a mirror image of the order in which they can occur in a coda, and so forth. (None of these rules, incidentally, are wholly exceptionless.) Some studies have provided more elaborate general rules defining permissible sequences. The more general a rule is, however, the more likely it is to permit some sequences that are not actually attested (or to prohibit some that are). Thus, Whorf's well-known formula generates such unattested sequences as /-fθt/, /-lbzd/, and /-ksθst/. L. G. Jones has rules that permit sequences like /-bdzd/, /-čtst/, /-ljdz/, and /-rkts/. Other studies predict yet other clusters. Some of these hypothetical sequences are easily imaginable; others seem less probable. In those studies that include rules, as distinct from lists, more than 130 unattested clusters are predicted by some general rule or other and are, from the standpoint of occurring clusters, instances of overgeneralization.

3. Discrepancies of Word Class. By no means all discrepancies between phonotactic lists are due to the mechanics of the description. Some result from differences in the range of lexical items covered by a description. All

⁷ John S. Kenyon, "Syllabic Consonants in Dictionaries," *American Speech*, XXXI (1956), 245-51, here 248.

⁸ Daniel Jones, *English Pronouncing Dictionary*, 11th ed. (London: Dent, 1956), s.v.

phonotactic grammars try to account for the common, everyday vocabulary, but some include also special kinds of words with clusters not in the common vocabulary, whereas other descriptions avoid such words.

Proper names may contain clusters that are unusual in appellatives. Thus /bw-/ is found in place names like *Buenos Aires*, *Buena Vista*, and *Buena Park*. The Argentinian capital is also pronounced /bow-/ or /bɔy-/, and the Mexican and California cities have variants beginning /byuw-/, it being typical of such words that they develop alternative pronunciations with more "normal" sound sequences. The given names *Gwen*, *Gwyn*, and their longer forms have /gw-/, which occurs also in more or less foreign appellatives like *guava* and *guano* and in the dialectal *gwine*. Other initial clusters in names are /dn-/ *Dnieper*, /de-/ *Dvořák* (also the technical term *dvandva*), /pn-/ *Pnompenh*, /sny-/ *Snewin*, /tl-/ *Tlingit*, /vl-/ *Vladivostok* or *Vlasic*, and /zw-/ *Zouave* or *Zwingli*. The final cluster /-mk/ has been recorded for *Hamtramck*, although the city in Michigan has a pronunciation with a svarabhakti vowel /-mik/, which breaks up a cluster that otherwise violates universal expectations about homorganic sequences of nasal and stop. Other final clusters in words of this sort are /-nf/ *Banff*, /-nsk/ *Minsk*, /-nš/ *Blanche*, /-pf/ *Zipf*, /-rnst/ *Ernst*, /-rpst/ *Harpst*, and /-rž/ *La Farge*.

Clusters in loanwords of relatively recent date differ from those in the native or the thoroughly naturalized vocabulary. The Swahili loanword *bwana* has /bw-/, already mentioned in connection with proper names. Other initial clusters that are attested in distinctly foreign words are /fw-/ *foie gras*, /fy-/ *fjord* (before /-uw/ as in *few*, the cluster is completely normal), /kn-/ *knish*, /kš-/ *Kshatriya*, /mw-/ *moire*, /nw-/ *noir*, /pf-/ *pfennig*, /šl-/ *schlock*, /šm-/ *schmaltz*, /šn-/ *schnitzel*, /št-/ *shtick*, /šw-/ *schwa* (sometimes normalized as /šəwa/), /vw-/ *voyageur*, /zbr-/ *sbrinz*, /zl-/ *zloty*, /žw-/ *joie de vivre*. Final clusters of the sort are /-nž/ *blancmange* and /-ršč/ *borsch*.

Some clusters occur in only a few words or, at the extreme, in a single word. Such words may themselves be of low frequency, some extremely rare. Because of the limited number of items in which such a cluster occurs and because of the rarity of the items, the cluster may be nonoccurring for some English-speakers. Examples are /gy-/ *gules*, /sf-/ *sphere*, *sphinx*, *sforzando*, *sfumato*, *sphagnum*, *sphincter*, and so on (/sf-/ being the most common of the sequences mentioned in this paragraph), /sfr-/ *sphragistics*, /skl-/ *sclaff*, *sklent*, *sclerosis*, /smy-/ *smew*, /sθ-/ *sthenic*, /vr-/ *vraic*, /zy-/ *zeugma*. A final cluster of the kind is /-rsk/ *torsk*.

Obsolete or archaic words may preserve consonant clusters that otherwise do not occur: /zbl-/ *'sblood*, /zd-/ *'sdeath*.

Some sequences occur only in nonce forms. Hultzén mentions having seen *ACTH*, the abbreviation for *adrenocorticotrophic hormone*, spelled in lower case as *acth*, which may imply an otherwise unattested final cluster /-kθ/. Hill (p. 81) cites /-pft/ in *Zipfed*, preterit of the verb *Zipf* ‘analyze language in the manner of G. K. Zipf.’

Imitative words may include clusters that are rare or nonexistent elsewhere in the vocabulary: /vr-/ *vroom* ‘sound of an object, such as a sports car, passing at high speed,’ /sl-/ *schloop* ‘sound, for example, of water draining from a sink,’ /pf-/ *phfff!* (title of a 1954 motion picture, pronounced either without a vowel [pʰt] or more conventionally /pft/).

Ejaculations may involve not only unusual combinations, but unusual sounds as well. Because they are conventional imitations of nonspeech noises, they are on the borderline between language and nonlanguage. Thus, the ejaculation *tsk-tsk*, originally a spelling to represent the non-speech lamino-palatal click used in expressing disapproval, may be given a conventional pronunciation /tisk tisk/, which is sometimes substituted for the click and is normal in both sounds and combination.⁹ Although it is an odd combination in being vowelless, *pst* consists entirely of normal English speech sounds. On the other hand, the ejaculation spelled *yecch* or the like is often pronounced with a strong palatal fricative [yeç], a sound that does not occur in “normal” Modern English words. The ejaculation spelled *whew* is often pronounced [wyu], which is odd both in the voiceless vowel and the cluster of two semivowels (although /hw-/ and /hy-/ are both regular in some forms of English, /hwy-/ is otherwise unexampled).

Slang expressions also include otherwise rare clusters: /ʃm-/ as in *data-shmata* or any of the innumerable similar reduplicative formations. So too, /ʃn-/ in *schnook*. Slang vocabulary is also characteristic of a special register or style, and it therefore overlaps with the next category.

4. Discrepancies of Language Variety. When different descriptions restrict themselves to different language varieties, a consequence is likely to be discrepancies in the consonant clusters they recognize. Language varieties that are especially relevant are geographical or social dialects and various styles.

One of the ways dialects differ is in their sequences of consonants. Some forms of English allow coronal sounds to be followed by the coronal semivowel in stressed syllable onsets, whereas others do not. Those that permit the combination have /dy-/ *due*, /ly-/ *lute*, /ny-/ *news*, /sty-/ *stew*, /sy-/ *sue*, /ty-/ *tube*, /θy-/ *thew*, and perhaps /čy-/ *chew*, /ʃy-/ *juice*, and *sly-*

⁹ This example and several other like ones are cited by Thomas Pyles, *The Origins and Development of the English Language*, 2d ed. (New York: Harcourt, 1971), pp. 277–79.

sluice; /ry-/ *rule* is sometimes included in this group, but the sequence is suspicious ([rɪu] is attested but uncommon). However, even those speakers who lack /dy-/ in *due* may have it in *do you think so?* /dyə . . /. So also some dialects have /hw-/ *which*; others do not. Most forms of English have /ʃr-/ in *shred* and similar words, but many speakers in the southeast of the United States have /sr-/ instead. (In the majority pronunciation, /sr-/ may occur in a loanword like *sri* 'Indian title of respect' or in the place name *Srinagar*.) Dialect variation affects final clusters also: *bulge* may end in either /-lj/ or /-lʒ/, and similarly the preterit *bulged* in /-ljd/ or /-lʒd/. Some speakers distinguish *welsh* with /-lʃ/ from *welch* with /-lč/; others do not.

Stylistic differences are more striking. In what is sometimes thought of as "rapid" speech, but in fact is everyday informal style, there is a good deal of syncope of unstressed vowels, in comparison with the pronunciation of citation forms.¹⁰ Syncope, especially when it affects the initial syllable of a word stressed on the second syllable, as in /ʃræf/ for *giraffe*, produces some consonant clusters that do not occur, or only very rarely occur, in unsyncopeated style. Examples of such consonant clusters, which are not recorded in any treatment of English phonotactics, except incidentally as they happen to occur also in proper names or the like, are /čl-/ in the second syllable of *actually* /ækčliy/ (strictly speaking, part of interlude rather than onset; several such examples are cited here); /čr-/ *cherubic*; /čw-/ *actual* /ækčwəl/; /dl-/ *dilemma*, *delightful*, *Duluth*; /fn-/ *fanatic*, *finagle*, *financial*; /ʃl-/ *jalopy*, *gelatinous*; /ʃr-/ *giraffe*, *Jerusalem*, *juridical*, *geranium*; /kn-/ *canoe*, *canary*, *canal*; /ml-/ *molesting*, *militia*, *malinger*; /mr-/ *maroon*, *meringue*, *marine*, and the second syllable of *admiral* /ædmrəl/; /pt-/ *potato*; /sg-/ *spaghetti* /sgediy/; /sr-/ *serenity*, *sarong*, *sorority*, *surround*; /ʃv-/ *chivalric*; /tl-/ *telegraphy* and the second syllable of *capitalist* /kæptlist/; /tm-/ *tomato*, *tamale*; /vl-/ *valise*, *validity*, *velocity*; /vn-/ *vernacular* (with prior loss of the first *r* by dissimilation), *Vanessa*; /vr-/ *veranda*, *variety*, *virility*; /wl-/ *usually* /yuʒwliy/.¹¹

As a consequence of their morphemic structure, some words have consonant sequences that violate the rule of voicing harmony in obstruent clusters. Assimilation in informal style may restore that harmony and create pronunciation variants for these words: /-dst-, -tst/ *midst*, /-dθ-, -tθ/ *width*, /-dθs-, -tθs/ *widths*, /ndθ-, ntθ/ *thousandth*, /-ndθs, ntθs/ *thousandths*.

Some clusters occur only or chiefly in a spelling-conscious style of pronunciation of words for which there is an alternative pronunciation without the cluster. Thus, /pw-/ is found in *pueblo*, *puissant*, and *Puerto Rico*, but the

¹⁰ John Algeo, "Syncope in English," *South Atlantic Bulletin*, XXXIX, no. 4 (November 1974), 22–30; "Syncope and the Phonotactics of English," *General Linguistics*, 15 (1975), 71–78.

¹¹ For a number of these examples, I am indebted to James B. McMillan.

first is also pronounced /puweblow/ (the pronunciation regularly used by newscasters in referring to the name of an American ship involved in an incident with North Korea some years ago), the second has a traditional pronunciation beginning /pyuwis-/, and the third has a popular variant *Porto*. Other such clusters with their alternatives are /bd-/ or /d-/ *bdellium*, /dn-/ or /dæn-/ or /n-/ *Dnieper*, /fθ-/ or /θ-/ or /t-/ *phthisis*, /gn-/ or /n-/ *gneiss*, /gz-/ or /z-/ *xylophone*, /mn-/ or /n-/ *Mnemosyne*, /pny-/ or /n-/ *pneuma*, /ps-/ or /s-/ *psoriasis* (the heartbreak of which is doubtless much aggravated by the /p/), /psy-/ or /s-/ *pseudo*, /pš-/ or /š-/ *pshaw*, /pt-/ or /t-/ *pterodactyl*, /sgr-/ or /skr-/ or /zgr-/ *sgraffito*, /sv-/ or /sf-/ *svelte*, /tm-/ or /təm-/ or /m-/ *tmesis*, /ts-/ or /t-/ or /s-/ *tsetse*, /tsw-/ or /zw-/ or /sw-/ *zwieback* (when /tsv-/ is recorded it is generally considered a foreign pronunciation). Many of the foregoing clusters show the influence of orthography, but the final cluster /-bst/, recorded for *Pabst*, if it really occurs, represents a triumph of spelling over custom, articulation, and etymology. The /-ln/ in *kiln* likewise is due to spelling, although the same cluster occurs in *swollen* as the result of syncope. An orthographically supported /-mb/ occurs in *gamb*, *rhomb*, and *rhumb*, although not in the native *lamb* or the naturalized *plumb*. *Isthmus* and its derivatives have a spelling pronunciation with the otherwise nonoccurring interlude /-sθm-/, which presupposes either /-sθ/ or /θm-/.

Many theoretically possible clusters do not actually occur, at least in normal speech as opposed to spelling-conscious styles such as the careful articulation of citation forms. In normal speech there is a strong tendency to simplify clusters.¹² Thus the following words often, perhaps usually, have the clusters indicated rather than those suggested by their spellings: *rafts* /-fs/, *fifths* /-fs/ or /-θs/, *texts* /-ks/ (which has as an odd consequence that an English noun forms its surface plural by dropping the final consonant of the singular: singular /tekst/, plural /teks/), *facts* /-ks/, *twelfth* /-lθ/, *twelfths* /-lfs/ or /-lθs/ or even /-ls/, *sends* /-nz/, *months* /-ns/ or /-nts/, *scripts* /-ps/, *worlds* /-rlz/, *asked* /-st/, and so on for a good many others. A noteworthy simplification is that of the -s inflected form of words ending in -st, for example the plural of *test*. Besides the citation form /tests/, there is in some speechways a plural /tess/, which contrasts with /tes/ *Tess* (a girl's name), producing at least a surface contrast between short (or single) and long (or double) /s/ in final position. In other speechways the contrast is not maintained, so that the plural of /test/ is /tes/. Consonant clusters that are actually pronounced in normal connected speech are probably a good deal fewer in number and on the whole less complex in structure than those that are possible in citation forms. It is a noteworthy fact about English usage

¹² Bertil Malmberg, "Stability and Instability of Syllabic Structures," *Proceedings of the Fifth International Congress of Phonetic Sciences* (Basel: Karger, 1965), pp. 403–8.

that many speakers who regularly pronounce reduced clusters would, if asked to express an opinion about their acceptability, unhesitatingly reject them as “careless,” “sloppy,” or “substandard.”

Special imitative styles of speech may also include unusual clusters. The “drunk” style (which is, of course, not the actual speech pattern of an inebriate but rather a conventionalized representation of such speech) involves a general substitution of /ʒ/ for /s/, consequently producing such clusters as /ʒk-/ *shchool* for *school* and /ʒp-/ *shpot* for *spot*. The “drunk” style has a bearing on an old quarrel—whether the affricate in *church* should be analyzed as a unitary /tʃ/ or a binary /tʃ/.¹³ Initial /ts/ is rare in English, so it is difficult to use it effectively as a test, but final /ts/ is very common, for instance in *let’s* or *cats*. In “drunk” style those items become /letʃ/ and /kætʃ/, contrasting with /leʃ/ *letch* and /kæʃ/ *catch*. The existence of this contrast, however marginal it may be, would seem to require the unitary analysis in autonomous phonology. Another special variety of language, the “lisp” or “sissy” style, used conventionally to represent the speech of male homosexuals, involves a similar substitution of /θ/ for /s/, thus producing a large range of clusters that have gone unrecorded in studies of English phonotactics, such as /θl/ *thlink* for *slink*, /θt/ *thtop* for *stop*, and /θm/ *thmile* for *smile*. Yet another special variety is the “baby-talk” or “Elmer Fudd” style, in which /w/ replaces /r/, as in /spw/ *spwy* for *spry* and /fw/ *fwame* for *frame*.

5. Discrepancies of Linguistic Component. The component of a linguistic description for which phonotactic rules are written will have a bearing on the clusters that are predicted. Lexical redundancy rules that apply to underlying forms will not predict the same clusters as phonotactic rules that account for surface systematic phonetic, or for autonomous phonemic, forms, although if the rules are properly framed, lexical redundancy rules plus phonological rules ought to yield the surface clusters. Nevertheless, vocabulary items in the lexicon and syllable strings in the stream of speech do not have the same phonotactic structure. Tactic discrepancies between underlying and surface levels are partially dependent on style or dialect, as shown by some examples already cited.

In addition, for many speakers of English, the sequence nasal plus voiceless fricative and the sequence nasal plus homorganic voiceless stop plus voiceless fricative are not contrastive; for words in which the former sequence would be expected etymologically or morphologically, an intrusive stop creates the latter. Examples are: /-mf, -mpf/ *lymph*, /-mfs,

¹³ W. Freeman Twaddell, “/tʃ/?” *American Speech*, 47 (1972), 221–32. Charles F. Hockett, “If You Slice It Thin Enough, It’s Not Baloney,” *American Speech*, 47 (1972), 233–55.

-mpfs/ *nymphs*, /-mft, -mpft/ *humphed*, /-rmθ, -rmpθ/ *warmth*, /-rmθs, -rmpθs/ *warmths*, /-rmθt, -rmpθt/ in hypothetical although probably nonexistent *warmthed*, /-ns, -nts/ *sense*, /-nst, -ntst/ *sensed*, /-nθ, -ntθ/ *tenth*, /-nθs, -ntθs/ *tenths*, /-nθt, -ntθt/ in hypothetical *tenthed*, /-ŋθ, -ŋkθ/ *length*, /-ŋθs, -ŋkθs/ *lengths*, /-ŋθt, -ŋkθt/ in hypothetical *lengthed*.

A similar intrusion occurs between a nasal and a nonhomorganic stop in *dreamt* with /-mt, -mpt/; in *empty* (from earlier *emty*, OE *āmettig*) it has come to be reflected in the orthography, although the word is currently pronounced both with and without the /p/. In *instinct(s)* the homorganic stop after the nasal may be omitted to achieve a parallel set of clusters, /-ŋt, -ŋkt/ and /-ŋts, -ŋkts/, and similarly in *jinx(ed)* /-ŋs, -ŋks/ and /-ŋst, -ŋkst/.

Intrusion has also been reported after /l/ or a voiceless fricative in *false* /-ls, -lts/, *health(s)* /-lθ, -ltθ; -lθs, -ltθs/, *twelfth(s)* /-lfθ, -lftθ; -lfθs, -lftθs/, *fifth(s)* /-fθ, -ftθ; -fθs, -ftθs/, *sixth(s)* /-ksθ, -kstθ; -ksθs, -kstθs/ (in reality usually simplified to /-ks/).

A similar alternation exists between /-lč/ and /-lš/ as in *mulch* and between /-lj/ and /-lž/ as in *bilge*. So too /-nš/ and /-nž/, which are extremely rare, occurring mainly in foreignisms like *Blanche* and *blancmange*, alternate with the more common /-nč/ and /-nǰ/ respectively. Phonetically, these alternations involve the intrusion or omission of a homorganic consonant and might be taken as evidence for the binary analysis of /č/ and /ǰ/.

Such instances of intrusion (or omission) can be accounted for as simple discrepancies between the structure of underlying and of surface forms.

6. Discrepancies of Rank. Another kind of discrepancy arises from differences in the hierarchical rank of the items to which the phonotactic rules apply. Thus if the rules operate on the purely phonological level, they may apply to syllables or to larger units such as stress groups. If the rules apply to syllables, they will predict onsets, nuclei, and codas; if they apply to stress or intonation groups, they will have to predict also interludes. That difference may not seem crucial in English, where it appears that practically all interludes can be accounted for as sequences of codas plus onsets. However, some unexpected sequences are encountered in continuous texts. Roberts (p. 61) cites /-sd/ from *They released him from jail* and /-šd/ from *He accomplished it*, sequences that are unlikely in citation forms. Scholes (p. 18) cites initial /tsf-/ from *It's a fine day* as an occurring sequence that is not "fully grammatical." The variety of such clusters in relaxed speech is certainly very great and increases among higher-ranked units, such as stress and intonation groups. Other examples of the same sort are /jw-/ *Did you want to?* /jwɔnə/; /km-/ *Come here* /kimr: /zb-/ 's *been nice*; /zg-/ 's *good*; /zv-/ 's *very good*.

If the rules operate on the lexical level, a difference in rank is also important, for rules that apply to morphemes will differ significantly from rules that apply to words or larger units like phrases. The consonant clusters that occur within a morpheme are much fewer in number than those that occur within a word, when morpheme boundaries are ignored.

Studies of English phonotactics have often defined their domain by mixed criteria, such as monosyllabic words or monosyllabic morphemes, but the rank difference is still crucial. In particular there are sequences of consonants that occur only or mainly with an intervening morphemic boundary. If the domain of study is the word (or the syllable) such clusters will be included; but if the domain of study is the morpheme, they will be excluded or will be at best marginal, because very rare. Examples of such clusters are those below (in these lists, rare occurrences of the sequence without internal morpheme boundary are illustrated by examples in parentheses).

Only a limited number of vowelless morphemes produce these clusters, among them the preterit or participial *-ed*: /-bd/ *robbed*, /-bzd/ hypothetical *Babsed* (preterit of a nonce verb meaning 'act like a person named *Babs*'), /-čt/ *touched*, /-dzd/ *adzed*, /-gd/ *bagged*, /-gzd/ hypothetical *Meigsed*, /-jd/ *paged*, /-kst/ *fixed* (*text*), /-lbd/ *bulbed*, /-lčt/ *filched*, /-lft/ *gulfed* (*delft*), /-lkst/ hypothetical *calxed*, /-lkt/ *sulked* (*mulct*), /-lmd/ *filmed*, /-lnd/ *kilned*, /-lpt/ *helped* (*sculpt*), /-lst/ *pulsed*, /-lšt/ *welshed*, /-ltst/ *waltzed*, /-lvd/ *shelved*, /-lzd/ hypothetical *Knowlesed*, /-md/ *trimmed*, /-mpst/ *glimpsed*, /-mpt/ *jumped* (*prompt*), /-mzd/ hypothetical *Jamesed*, /-nčt/ *punched*, /-njd/ *changed*, /-ntst/ *chintzed*, /-nzd/ *bronzed*, /-ŋd/ *wronged*, /-ŋkst/ *jinxed* (*angst*), /-ŋzd/ hypothetical *Cummingsed*, /-pst/ *lapsed* (*Pabst*), /-rbd/ *curbed*, /-rbzd/ hypothetical *Forbesed*, /-rčt/ *arched*, /-rft/ *dwarfed*, /-rjd/ *merged*, /-rkst/ hypothetical *Marxed*, /-rkt/ *marked*, /-rld/ *curled* (*world*), /-rlt/ *spoilt* (a facetious pronunciation recorded by Hill and thereafter reported seriously by at least one study), /-rlzd/ hypothetical *Charlesed*, /-rmd/ *stormed*, /-rnd/ *earned*, /-rpt/ *harped* (*excerpt*), /-rst/ *forced* (*burst*), /-rtst/ hypothetical *Hertzed*, /-rθt/ *unearthed*, /-rvd/ *curved*, /-rzd/ *parsed*, /-skt/ *masked*, /-spt/ *clasped*, /-št/ *fished*, /-tst/ *blitz*, /-θt/ *frothed*, /-čd/ *smoothed*, /-vd/ *saved*, /-vzd/ hypothetical *Clevesed*, /-zd/ *used*, /-žd/ *rouged*.

Also highly productive of consonant clusters are the various *-s* morphemes (the noun plural, the genitive, and the third person singular verbal ending): /-bz/ *jobs*, /-fs/ *cuffs*, /-fts/ *rafts*, /-gz/ *legs*, /-ksts/ *texts*, /-kts/ *facts*, /-lbz/ *bulbs*, /-ldz/ *builds*, /-lfs/ *gulfs*, /-lfts/ *delfts*, /-lks/ *silks* (*calx*), /-lkts/ *mulcts*, /-lmz/ *films*, /-lnz/ *kilns*, /-lps/ *helps*, /-lpts/ *sculpt*s, /-lts/ *salts* (*waltz*), /-lvz/ *shelves*, /-lzl/ *pals* (*gules*), /-mps/ *jumps* (*glimpse*), /-mpts/ *prompts*, /-mz/ *games*, /-ndz/ *sends*, /-nts/ *cents* (*chintz*), /-ŋks/ *inks* (*jinx*),

/-ŋz/ *things*, /-psts/ *Pabsts*, /-pts/ *crypts*, /-pθs/ *depths*, /-rbz/ *curbs*, /-rdz/ *beards*, /-rfs/ *scarfs*, /-rnsts/ *Ernst's*, /-rgz/ *morgues*, /-rks/ *parks*, /-rldz/ *worlds*, /-rlz/ *curls*, /-rmz/ *storms*, /-rnz/ *earns*, /-rps/ *harps (corpse)*, /-rpsts/ *Harpst's*, /-rpts/ *excerpts*, /-rst/ *bursts*, /-ršt/ *borschts*, /-rts/ *parts (quartz)*, /-rθs/ *hearths*, /-rvz/ *curves*, /-rz/ *stars (furze)*, /-sks/ *masks*, /-sps/ *clasps*, /-sts/ *boasts*, /-ts/ *hats (blitz)*, /-tθs/ *eighths*, /-θs/ *myths*, /-ðz/ *smooths*, /-vz/ *saves*.

A few additional clusters are due to other vowelless morphs, for example, the *-th* of ordinal numbers or of abstract nouns: /-tθ/ *eighth* (in one common pronunciation) and /-pθ/ *depth*. The contraction *aren't* has /-rnt/ (also found in the irregular *learnt*), and the plural of the citation form, *aren'ts*, has /-rnsts/. Whorf predicted an extensive set of clusters ending in the archaic second-person verbal inflection *-st*, pronounced either /-st/ or /-zd/; he cited /-mpfst/ as in *triumphst* or the hypothetical *oomphst* as an example. Verb forms in concord with *thou* are, however, not really viable in current English, and are becoming increasingly less so. Since the Standing Liturgical Commission of the Episcopal Church has had its way with prayer-book revision, the last institutionalized remnant of those forms will probably disappear. Even when they are used, the verbal ending is usually pronounced as a separate syllable /-əst/ as in *walkest*. Ironically, Whorf's formula does not predict at least one occurring cluster with that ending, /-dst/ in *didst*, because it violates the rule of voicing harmony in obstruent clusters.

7. Attested Clusters and Permitted Clusters. Almost all, if not indeed all, discussions of English phonotactics have assumed a distinction between those consonant clusters that are actually attested and those that are permitted by the phonotactic rules. Sometimes this distinction is explicitly made and sometimes it is only implicit, but it underlies most thinking about phonotactics, which assumes that there is some set of language-specific rules defining the various sequences of sounds that can occur, although all in fact do not. The situation is, however, somewhat more complex than that. First, there are sound sequences that are judged to be permitted and that are attested, for example /star/; such occurring vocables are English words. Second, there are sound sequences that are judged to be permitted but are unattested, for example, /stal/; such incidentally missing vocables are English, but are nonwords. Third, there are sound sequences that are judged to be unpermitted and are unattested for example, /tsal/; such inadmissible vocables are both non-English and nonwords. But there is a fourth class to be contended with, namely sound sequences that are judged to be unpermitted but are in fact attested, for example /tsar/; these

exceptional vocables are supposed to be non-English, but are words. They are not mere slips of the tongue, performance errors, but rather parts of the language that grammarians have preferred to ignore. They are illustrated abundantly on the preceding pages.

Such a fourfold distinction underlies, for example, the discussion of lexical redundancy rules by Chomsky and Halle¹⁴ and is implied by many other discussions. Instead of the two-valued permitted/unpermitted, a multi-valued scale of grammaticality is sometimes proposed.¹⁵ For instance items like /strʌk/, /strib/, /stwip/, and /gvsurs/ are cited as having measurable degrees of grammaticality or approximation to fully natural English. Such a scale presents a more complex picture that is doubtless closer to the facts, but it does not eliminate the basic problem caused by distinguishing between what is attested and what is grammatical (or possible or permitted) according to a set of rules. Consequently, the simpler classification is considered here.

Despite its elegant neatness, the fourfold taxonomy of vocables according to the two dichotomies attested/unattested and permitted/unpermitted (or an elaboration with degrees of permittedness) rests upon an assumption whose validity is not at all obvious. The assumption is that, quite apart from those sequences of sounds that actually occur in English, there are general rules that define acceptable, permitted sequences. However, if we are asked to decide whether a cluster is attested or unattested and also to decide whether it is permitted or unpermitted, we are being asked to make two quite different sorts of decisions. Whether a cluster is attested or not is empirically decidable, because if we discover an instance of the cluster, it is attested, and otherwise not. Attestation is an a posteriori question, fraught, to be sure, with all the uncertainty of any such problem and dependent on the skill and luck of the investigator as well as on the existence of the data being sought.

Whether a cluster is permitted or not is a quite different sort of question, an a priori one that presupposes a rule defining the permissible. The important question is, of course, whether such rules exist other than arbitrarily and, if so, how we can discover them. Although phonotactic studies have generally assumed the existence of that kind of rule, the evidence in its favor has been largely subjective and anecdotal, an appeal to "intuition." Thus Chomsky and Halle take a fairly typical position when

¹⁴ Noam Chomsky and Morris Halle, *The Sound Pattern of English* (New York: Harper, 1968), pp. 380–89.

¹⁵ Joseph H. Greenberg and James J. Jenkins, "Studies in the Psychological Correlates of the Sound System of American English," *Word*, XX (1964), 157–77. Scholes, *Phonotactic Grammaticality*.

they note that “speakers can distinguish in various ways among items that are not in their lexicon. Certain ‘nonsense’ forms are so close to English that they might be taken by the speaker to be accidental gaps in his knowledge of the language: e.g., *brillig*, *karulize*, *thode*. Other forms, such as *gnip*, *rtut*, or *psik*, will almost certainly be ruled out as ‘not English.’ To account for these and other facts, we must assume that there is more structure of the internalized lexicon than merely the list of known items,” namely, some set of “lexical redundancy,” “morpheme structure,” or other kind of phonotactic rules.

There is a common-sensicalness about the Chomsky-Halle observation, and yet efforts to make it explicit run into difficulties. Anecdotally, it might be objected that the often cited *brillig*, far from being a good English nonword that is accidentally missing from the lexicon, is rather a distinctly un-English-sounding vocable, because English words do not end in unstressed *-ig*. On the other hand, the initial clusters of *gnip* and *psik* do occur in English, the former in a syncopated pronunciation of *good night* /*gnayt*/ and the latter in an admittedly infrequent, but real, pronunciation of *psychology*. If Aristotle was right in supposing that historical events make good subjects for tragedy because the latter deals with possible actions and what has happened may be presumed to be possible, we might suppose that sound sequences that actually occur are good subjects for phonotactic rules because the latter describe possible combinations and what has occurred may be presumed to be possible.

Efforts to discover rules that define what is phonotactically possible, apart from what is attested, take two forms. They investigate either the behavior of language users or the internal coherence of the language system. As Greenberg and Jenkins observe (p. 158), “Faced with the present problem, the reaction of the psychologist and linguist is characteristically different. The psychologist immediately thinks of experiments and subject reaction. The linguist reaches for pencil and paper and works for refinement of definitions based on logico-mathematical manipulations of the structure of existing forms in the language.” The approaches are not incompatible, but neither has been wholly successful. Psycholinguistic experiments almost never yield unambiguous results, because of the complexity of the subject. On the other hand, the abstract constructs of the linguistic theorist must somehow be validated, and if, as in this case, simple attestation of forms is ruled out as a means of validation, he tends to rely on “intuition.” But introspection is a journey through the palpable obscure, where the opportunities for innocent self-deception are great.

Despite the difficulty of defining the notion “possible” apart from the actual occurrence of forms, it does seem to correspond to something in

language. Lack of some sequences in English, for example, does indeed appear to be an accidental hole in the system judging by both the reactions of native speakers¹⁶ and the symmetry of the system. Thus phonotactic studies generally prohibit /-lg/ as a possible final cluster, and there seems to be no genuine example of it in current English. However, /l/ is followed by all the other stops; and all stops, including /g/, occur after the other liquid, /r/. The nonoccurrence of /-lg/ seems to be an historical accident. Old English had monosyllables like *dolg* 'wound,' *belg* 'bag,' and *bealg* '(he) got angry.' Either such words have been lost altogether in Modern English or the *g* has been vocalized, as in *belly* and *bellows*. The general system by which English sounds enter into combination with one another offers no explanation for the lack of /-lg/, which thus appears to be merely fortuitous. Similarly, the lack of /stw-/ in English is not predictable by general rule. Indeed, quite the opposite. Whenever initial bisegmental clusters like /sp-/ and /pr-/ are possible, we expect that a portmanteau trisegmental cluster like /spr-/ is also possible. However, although /st-/ and /tw-/ both occur, /stw-/ is lacking from most varieties of English.

Thus there are clearly grounds for saying that unattested clusters may nevertheless be possible. If an unattested cluster fills an isolated hole in the pattern of attested clusters we can reasonably call its lack accidental. The two clusters /-lg/ and /stw-/ are of this kind:

-lp	-lt	-lč	-lk
-lb	-ld	-lǰ	(-lg)
sp-	st-	sk-	st-
pl-	tr-	kw-	tw-
spl-	str-	skw-	(stw-)

On the other hand, it is much harder to justify calling an attested cluster impossible. If a cluster falls outside a matrix like those above for /-lg/ and /stw-/, we can call it, if not impossible or unpermitted, at least exceptional. Thus, some onset clusters of /s/ and another obstruent are nonoccurrent, and others are rare, extremely so if the other obstruent is voiced:

	sp	st		*sč	sk
	*sb	*sd		*sǰ	*sg
	(sv)	*sð	*sz	*sž	
	(sf)	(sθ)	*ss	*sš	

¹⁶ Roger W. Brown and Donald C. Hildum, "Expectancy in the Perception of Syllables," *Language*, XXXII (1956), 411-19.

Starred clusters (which are either very rare or unattested) can be ruled out by two general rules: (1) Two sibilants do not occur in succession in a cluster. (2) All obstruents in a cluster agree in voicing. Those two rules leave /sf-/ and /sθ-/ as quite regular clusters, whose infrequency must be attributed to happenstance unless a third rule is added: (3) An onset cluster does not contain two fricatives (or perhaps rather something like: If an onset cluster contains two obstruents, the second must be a stop). It is not clear whether those two clusters are best regarded as exceptions or as infrequent regularities. There are, however, good reasons for calling /sv-/ exceptional. It violates rule (2) above, which is of great generality, as well as the moot rule (3), and it is an extremely rare cluster, occurring only sporadically in *svelte* and possibly in a few other items like *svedberg* and *Svengali* (although I know of no attestations for /sv-/ in the latter words).

When a cluster is in violation of a very general rule and is also of rare occurrence, like /sv-/, we may be tempted to condemn it to whatever outer darkness awaits those combinations that occur but that we have decided ought not to. To yield to that temptation, however, is to play the capricious deity in drawing artificial lines around the realities of phonology. A rare cluster that violates rules is exceptional, but if it occurs, it cannot be rejected as impossible. Phonotactic rules cannot define what is English, but only what is systematic in English.

Instead of coordinate questions, *Is this sequence permitted?* and *Does this sequence occur?* which neatly yield four classes of vocables, we should rather ask our questions in a hierarchical order and not suppose that all of them need *yes-no* answers:

Is this sequence attested?

If so, in how many items of what frequency and under what stylistic limitations of occurrence?

And whether it is or not, to what extent is the sequence locatable within a matrix of sequences (that is, to what extent can the sequence be predicted by general rule)?

Answers to questions such as these will not define some neat set of three or four classes of vocables, but rather a continuum of several dimensions, reflecting the messiness and uncertainty of the data. But answers to such questions may also account for the native speaker's feeling that some combinations are "more English" than others. Combinations that occur in many lexical items of high frequency and fill an interstice in a matrix of combinations are "very English." Combinations that occur in fewer items or only in items of low frequency or only in items that are stylistically limited or that fall outside a neat matrix are "less English." Combinations

that do not occur, but do fill an interstice may be “more or less English” than the foregoing. And combinations that do not occur and fall outside a matrix are the “least English” of all. Ranking combinations according to several multivalued criteria like those implied by the questions above, with appropriate weights assigned to each criterion, may account for the reaction English speakers have to the “possibility” of various combinations like /st-/, /sf-/, /sθ-/, /θt-/, /stw-/, /ft-/, and /vt-/. Such ratings would be extremely complex and might be expected to vary greatly in psychological reality from one speaker to another. They would be a far cry from any simple set of phonotactic rules specifying “possible” combinations.

There is already available a good deal of data on the type and token frequency of clusters,¹⁷ and there have been a number of efforts to arrive at principles to determine phonotactic regularity or grammaticality.¹⁸ But studies into frequency invariably begin with a corpus that prejudices the results; for, as the examples cited above in sections 2–6 show, the very occurrence of clusters differs markedly according to several factors: the methods of analysis, word classes, language varieties, linguistic components, and hierarchical ranks chosen for investigation. As the scope of investigation is broadened, so is the number of clusters that can be attested. Finally, one is led back with renewed respect to the view of Martin Joos that in language almost anything is possible. The search for principles is not very far advanced either. We know little about phonotactic universals; and the search for language-specific rules has invariably limited itself to some small portion of that vast, diverse, and intractable reality that is English.

8. Conclusion. To return to the discrepancy with which this inquiry began, namely the fact that studies of English phonotactics disagree strikingly about what clusters are possible in English—a conclusion now suggests itself. The discrepancy is due to a variety of causes: to differences in the way the data is observed and analyzed, to differences in the dialect or style of the language being accounted for, to differences in the range of lexical items being accounted for (whether common vocabulary, proper names, foreign words, slang, or whatnot), to differences in the grammatical rank of the

¹⁷ For example: Godfrey Dewey, *Relative Frequency of English Speech Sounds* (Cambridge: Harvard Univ. Press, 1923; revised 1950). Hultzén, Allen, and Miron, *Tables of Transitional Frequencies*. Roberts, *A Statistical Linguistic Analysis*.

¹⁸ For example: Bohumil Trnka, “General Laws of Phonemic Combinations,” *Travaux du Cercle Linguistique de Prague*, VI (1936), 57–62. Sol Saporta, “Frequency of Consonant Clusters,” *Language*, XXXI (1955), 25–30; “Phoneme Distribution and Language Universals,” in *Universals of Language*, 2d ed., ed. by Joseph H. Greenberg (Cambridge: MIT Press, 1966), pp. 61–72. Scholes, *Phonotactic Grammaticality*.

items described (morphemes or words), and to differences in the language level under investigation (underlying or surface forms, lexical items or syllables). But above all, the discrepancy is due to the wrong question having been asked. Is this cluster possible in English? is a pseudo-question that has no proper answer because it assumes the existence of a clear distinction between the possible and the impossible, and that dichotomy is a false one. The set of English consonant clusters, like some other aspects of language, is an ill-defined set.¹⁹ We can answer in some coherent way a question about whether a particular combination of sounds is more or less expectable in English, in terms of the criteria suggested above. We cannot determine, in any nonarbitrary, publicly verifiable way, whether a particular combination of sounds is possible, as opposed to actual, in English. And therefore it is hardly surprising that attempts to make such determinations have disagreed. A detailed examination of the consonant clusters that are actually attested for English leads to the conclusion that phonotactics is not properly a set of generative rules, because the sequences in which sounds combine cannot be predicted categorically.

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¹⁹ Charles F. Hockett, *The State of the Art*, Janua Linguarum, series minor 73 (The Hague: Mouton, 1968).