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A re-examination of phonological neutralization¹

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INTRODUCTION

One of the most fundamental constructs of phonological theory past and present is ‘neutralization’, i.e. the merger of a contrast in certain contexts. It is as basic as such other constructs as ‘contrast’, ‘distinctive feature’, and ‘segment’. While there exists a substantial body of literature on the phonetics of various phonological constructs (e.g. acoustic correlates for features, acoustic invariance, descriptive phonetics of particular languages, instrumental measurement techniques and segmentation criteria), the phonetics of neutralization has largely been assumed on the basis of casual impressionistic phonetics. The assumption is that forms which are distinguishable phonetically and phonologically in certain contexts and/or levels of representation (e.g. intervocalic voiced and voiceless obstruents in German) are under certain other well-defined circumstances totally indistinguishable at the level of phonetics (e.g. only voiceless obstruents occur word-finally in German). Very little experimental work is available that would contribute to establishing the facts of neutralization. Despite the paucity of empirical evidence on this point, neutralization has been widely accepted by both phoneticians and phonologists as a language phenomenon and is the essential subject matter of all known theories of phonology (Davidsen-Nielsen, 1978; 1983). In recent years, a number of theoretical proposals have made crucial reference to neutralization, assuming it to be a viable construct. Kiparsky’s Alternation Condition (Kiparsky, 1976) is an example where the construct of neutralization is essential to the formulation of constraints on abstractness of underlying representations and on rule ordering. Other proposals on rule interactions have been formulated in terms of this construct (e.g. Anderson, 1975; Kaye, 1975; Koutsoudas, 1980). There have also been efforts to explain substantive and functional properties of phonological rules in terms of a

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fundamental distinction between neutralizing and non-neutralizing rules (e.g. Schane, 1972; Houlihan & Iverson, 1979).

Recently, there have been a number of studies from diverse research concerns, the results of which raise serious questions about neutralization. One question is whether neutralizations actually occur. Some of the studies that bear on this question are reviewed below.

DEFINITION OF NEUTRALIZATION

While neutralization is understood to result in the merger of a distinction, the particular type of merger of interest here is that associated with a synchronically motivated context-sensitive phonological rule. Kiparsky (1976: 169) has offered the following definition of a neutralization rule adopted here and elsewhere:

A rule of the form

$$A \rightarrow B/XC_DY$$

is neutralizing if and only if there are strings of the form CBD in the input to the rule. Otherwise, the rule is non-neutralizing.

This definition is somewhat more restrictive than traditional conceptions of neutralization since some phonological mergers would be defined as non-neutralizing. For example, the English rule of Flapping, while merging the distinction between /t/ and /d/, would not be neutralizing since the rule produces flaps (i.e. segments that do not exist in the derivation prior to the flapping rule). See below for more discussion of this rule and its putative neutralizing effect. While this definition excludes certain mergers as neutralizing, it has been adopted as fundamental to many current theoretical proposals related to abstractness, rule interactions and substantive properties of rules as noted above.

Certain other mergers are irrelevant to this discussion. For example, rules of absolute neutralization (i.e. context-free mergers of the form $A \rightarrow B$) are excluded from consideration because they are not context-sensitive and are otherwise difficult to motivate synchronically. Similarly, unconditioned diachronic sound changes resulting in mergers are excluded from consideration.

WORD-FINAL DEVOICING

One phonological rule satisfying the definition of neutralization is the rule of Word-final Devoicing. This rule has been motivated for a number of languages and presumably involves the merger of voiced and voiceless obstruents in favour of voiceless in word-final position.

German. In one series of acoustic studies, Port, Mitleb & O'Dell (1981) and O'Dell & Port (1983) examined the phonetics of a celebrated phonological

neutralization, namely the rule-governed devoicing of obstruents word-finally in German. It is said that the final stops of *Leid* 'sorrow' and *leit* 'lead' are phonetically identical, although distinct in morphophonemically related forms. All previous phonological accounts of devoicing in German have assumed that a rule changes word-final underlying voiced obstruents into voiceless, resulting in the phonetic merger of the underlying distinction.² However, these studies reveal that word-final devoicing is not completely neutralizing, i.e. that underlying distinctions are preserved phonetically. In particular, it was found that a comparison of vowel durations before underlying voiced and voiceless obstruents word-finally showed longer vowel durations (by approximately 10%) before underlying voiced obstruents. Also, the underlying voiced obstruents evidenced somewhat more voicing into the consonant closure than did underlying voiceless obstruents. In addition, it was found that there is a significant difference (of the order of 15 msec.) in the aspiration duration of word-final underlying voiced and voiceless obstruents. On the other hand, there was no significant differences in the closure durations of underlying voiced and voiceless obstruents.

Catalan. The rule of word-final devoicing has also been claimed to function as a neutralization rule in Catalan (DeCesaris, 1980; Mascaro, 1978; Walsh, 1977; Wheeler, 1979, 1983). The phonetics of this putative neutralization were examined in a series of studies by Dinnsen (1982a,b) and Dinnsen & Charles-Luce (1984). It was found, contrary to the suggestion of phonological accounts, that the underlying voice distinction of word-final obstruents was being preserved for some speakers in either the contextual shortening of the preceding vowel or for other speakers in the overall closure duration of the final obstruent. For example, vowels phonetically shorten before word-final obstruents if the next word begins with a consonant (i.e. in the environment /— C # C). The crucial phonetic difference arises in the relative shortening of the vowel depending on whether it is followed by a word-final obstruent that is underlyingly voiced or voiceless. Vowels shorten significantly less if followed by an underlying voiced obstruent. For other speakers, the underlying voice distinction is preserved in the closure duration of the final obstruent such that underlying voiced obstruents are longer than underlying voiceless. Thus, the underlying voicing distinction was clearly marked, although different speakers marked this distinction using different cues.³

[2] The possible effects of word-final underlying voiced and voiceless obstruents on preceding vowel durations were examined instrumentally in Dinnsen & Garcia-Zamor (1971), but no differences were observed. The problems associated with the interpretation of null results are discussed later.

[3] The acoustic analysis failed to establish that these speakers as a group maintained the underlying voice distinction. The individual results did not establish phonetic differences for all speakers either. The fact that the acoustic analysis failed to establish a systematic distinction for the group as a whole and for some individual speakers cannot be interpreted

Russian. Russian is another language evidencing word-final devoicing of obstruents, presumably as the result of a phonological neutralization rule (Kenstowicz & Kisseberth, 1979). It appears, however, that the rule is not neutralizing, since vowels are phonetically longer before underlying voiced obstruents word-finally than before underlying voiceless obstruents in the same context (Chen, 1970).

Polish. Polish also exhibits word-final devoicing (Gussmann, 1978). The results from two instrumental studies suggest in this case as well that the rule is non-neutralizing, since the underlying distinctions are preserved phonetically in various acoustic and temporal properties associated with the final obstruent and neighbouring segments, e.g. preceding vowel duration, voicing into the closure, closure duration, and the burst (Giannini & Cinque, 1978; Slowiaczek & Dinnsen, 1984).

The above phonetic studies have all dealt with a single, common putative neutralization rule, namely word-final devoicing, for several different languages and have found in each case that the rule is, in fact, non-neutralizing. Several other putative neutralizations have also been examined instrumentally, the results of which are summarized below.

OTHER PUTATIVE NEUTRALIZATIONS

Turkish g-deletion. Rudin (1980) examined the putative neutralizing effect of g-deletion in Turkish. The claim is that phonetic long vowels can be derived from two sources underlyingly, i.e. /VgV/ and /V:/. Yet, they are presumed to be phonetically homophonous. It was found, however, that long vowels derived from underlying /VgV/ were 13% longer in duration than underlying long vowels.

English Flapping. The English rule flapping medial /t/ and /d/ after stressed vowels is often cited as an instance of neutralization (e.g. Donegan & Stampe, 1979: 146–147). While the merger of /t/ and /d/ would represent the loss of a contrast as with other neutralizations, the rule is, independent of any other considerations, non-neutralizing according to Kiparsky's definition since the resulting flap is itself not phonemic (cf. Kiparsky, 1976; Houlihan & Iverson, 1979). It is, of course, possible that this definition of neutralization

to mean that there were no phonetic differences corresponding to the underlying distinction. It is quite possible that differences did exist in other phonetic parameters not examined. For example, the amplitude of the burst release was not examined in this case, but has been identified as a relevant parameter for other languages. Moreover, the set of phonetic parameters associated with voicing in obstruents is large and as yet still open. Given the range of variation across speakers observed in these studies, it should not be at all surprising that individual speakers may select quite different, as yet unspecified, parameters for phonetic implementation. The individual variation across speakers would consequently fail to establish one common effect for the group as a whole.

is too restrictive and should be modified to admit rules such as flapping. In the event that such a redefinition is motivated, it is valuable to consider the phonetics of this merger as well.

Instrumental studies show, that for those American dialects examined, the vowel before those flaps derived from underlying /d/ are approximately 10% longer than the vowel before flaps derived from underlying /t/ (Fisher & Hirsh, 1976; Fox & Terbeek, 1977; Zue & Laferriere, 1979). The underlying distinction between /t/ and /d/ is thus preserved in the phonetic representation of vowel duration before flaps. It is commonly held, however, – based on a report from Joos (1942) – that there are two dialects of English relevant to this point. One dialect maintains a vowel length distinction before flaps from different sources, but the other dialect fails to maintain the distinction. The implication is that flapping results in a true merger for at least some dialects. It should be noted, however, that the Joos report did not instrumentally establish the facts. Rather, the claim of two dialects is based solely on impressionistic phonetic judgments. Interestingly, the many generative-oriented works that have advanced arguments about theory based on the existence of two dialects only assume the facts as presented in the Joos report.

One instrumental study that may be relevant to this point is that of Port (1976), in which no differences corresponding to underlying voicing were observed in either vowel duration or flap closure duration in the limited context of the high front lax vowel of New York City English. The phonetic parameters examined by Port were, however, limited to only two temporal factors associated with one vowel. Huff (1980) reports for the same dialect that the underlying voice distinction is preserved in spectral (rather than temporal) properties of the preceding vowel. Consequently, even where one instrumental study fails to identify phonetic differences corresponding to an underlying distinction, another study examining different phonetic parameters reveals systematic phonetic differences. As the range of phonetic parameters to be examined is permitted to increase, the possibility of identifying the correct parameters increases. As for two dialects of English differing in the merger effect of the Flapping rule, it appears instead that there may be two dialects, but two dialects differing only in the phonetic implementation of the underlying distinction. That is, both dialects preserve the distinction but in different ways – in terms of either temporal or spectral properties or some combination of the two.

Finally, even though the Flapping rule would not qualify under Kiparsky's definition as a neutralization rule (independent of the phonetic factors), it is interesting that the phonetics of this putative merger are not unlike the phonetics of any other putative mergers considered here.

English Stop Intrusion. It has also been claimed for at least some dialects of English that the distinction between /...ns.../ and /...nts.../ is neutralized by a rule inserting an oral stop between tautosyllabic sequences of nasal plus

fricative (e.g. Zwicky, 1972; Harms, 1973; Donegan & Stampe, 1979). There would, for example, be no distinction between such pairs of words as 'prints/prince', 'tents/tense', 'dents/dense', and in my dialect 'wants/once'. However, when experimental and instrumental techniques of analysis were brought to bear on the question, it was found that the distinction is not neutralized (Fourakis, 1980). Specifically, it was found that the inserted stops are shorter in closure duration than the intended stops. Also, the nucleus before the inserted stop is longer than before the intended stop. Thus, while a stop is inserted, there is no neutralization of a contrast since the inserted stop is different from the intended stop and it affects the preceding nucleus differently. Similar findings were reported by Ohala (1981). By Kiparsky's definition, then, the rule of stop intrusion is no longer neutralizing since it produces segment types that are systematically different from underlying segment types.

Final Consonant Deletion. It is often claimed that the speech of younger children (both normal developing and speech disordered) exhibits the loss of contrasts, primarily due to neutralization processes that simplify the output (Donegan & Stampe, 1979). There seems, however, to be little support for such a contention. There is, for example, evidence from functional (non-organic) speech disorders in younger children that putative neutralizations are not in fact neutralizing. For instance, a common articulation error is the omission of word-final obstruents (Ingram, 1976). For some children who omit word-final obstruents, it is appropriate to characterize the omission as a phonological deletion rule (Dinnsen, Elbert & Weismer, 1979, 1980; Dinnsen, 1984). Alternations of the following sort would motivate a rule of word-final obstruent deletion:

[da]	'dog'	[dagi]	'doggie'
[pɪ]	'pig'	[pɪgi]	'piggy'
[dæ]	'dad'	[dædi]	'daddy'
[mʌ]	'mud'	[mʌdi]	'muddy'
[dʌ]	'duck'	[dʌki]	'duckie'
[ka]	'cop'	[kapo]	'copper'
[fæ]	'fat'	[fæti]	'fatty'

Table 1

Final consonant omissions motivating a phonological rule of deletion.

A deletion rule accounting for such alternations would presumably neutralize a number of contrasts word-finally, e.g. obstruent voicing, place and manner of articulation. However, Weismer, Dinnsen & Elbert (1981) found that in such cases vowel durations are longer before omitted voiced obstruents

than before omitted voiceless obstruents. In other words, the voice distinction in final obstruents is not neutralized even though the obstruent is deleted, since the contrast is maintained in the preceding vowel durations. Moreover, evidence is presented by Weismer (1984) that the point of articulation contrast in the final omitted obstruents may not be neutralized either since vowel formant trajectories show different characteristic patterns depending on the underlying (phonetically omitted) obstruent.

The point which emerges from this discussion is that when experimental phonetic techniques of analysis have been used to examine a variety of putative neutralizations, systematic differences in production are found which correspond with underlying distinctions. It would appear then that such cases cannot, according to Kiparsky's definition, be characterized as neutralizations. Moreover, the phonetic effects of non-neutralizing rules (such as English Flapping under Kiparsky's view) do not appear to differ in any respects from the phonetic effects of putative neutralizing rules. These findings cast doubt on the very existence of neutralization and the correctness of the many theoretical constructs and principles that make assumptions about or reference to neutralization.

PERCEPTION AND PRODUCTION

The first question raised in an effort to salvage neutralization is: Are these production differences perceptible or discriminable? The intent of the question is clear; if the production differences that mark underlying distinctions are not discriminable, then it can be maintained that neutralization still obtains – at least perceptually. This appeal to perception raises interesting questions about the character of phonological rules and the presumed relationship between perception and production. One question is: What do phonological rules describe – perception or production phenomena? In generative theories of phonology, grammars are presumed to be neutral with respect to speaker and hearer (Chomsky & Halle, 1968) and thus represent an abstract characterization of phonology. Yet the question of whether production differences are discriminable suggests that any grammar (or neutralization rule) in question may not be neutral with respect to speaker and hearer, but rather may be more appropriate as a description of phonological perception. Any production differences would, therefore, be viewed as linguistically irrelevant. This position would, however, have awkward consequences for the phonological description of rule-governed allophonic (non-neutralizing) phenomena, i.e. different phonetic realizations of the same (systematic) phoneme. Allophonic rules are presumed to describe production differences which are not generally self-discriminable by naive listeners (Lisker & Abramson, 1967; Abramson & Lisker, 1970).⁴ Consequently, if it were

[4] It has been shown, however, that with training these differences can be discriminated by otherwise linguistically naive listeners (Pisoni, Aslin, Perey & Hennessy, 1982).

maintained that phonological rules specify segments differently only if their production differences are perceptually salient, phonological descriptions would exclude all allophonic statements.

There would be other undesirable consequences if phonological descriptions were limited to accounts of perception. In particular, a broad range of phenomena from language change and variation and from first and second language acquisition could not be treated phonologically or would otherwise have to be ignored. The findings from these areas strongly support the claim that perception and production are at least partially independent. To the extent that this claim may be correct, some insight is offered on the characterization of neutralizations.

Language change and variation. The now famous experimental studies of sound changes in progress by Labov, Yaeger & Steiner (1972) and Labov (1981) present evidence of dialect groups making systematic vocalic distinctions in association with differences in meaning when speakers themselves are unable to discriminate the production differences.⁵ Similar findings are reported by Costa & Mattingly (1981) for an Eastern New England dialect of English in which a systematic distinction is maintained in vowel duration for the two words 'cod' and 'card'. Specifically, the vowel in 'card' is longer. However, in an experimental test speakers of the dialect were unable to discriminate between the two tokens. Most recently, Janson (1983) plotted changes in perception and production across different generations and found that perception lags behind production. In addition, Janson & Schulman (1983) found that speakers of the Lycksele dialect of Swedish produce a systematic distinction between /e/ and /ɛ/, yet they are unable to distinguish the two perceptually.

First-language acquisition. A common substitution by young children during the normal development of English is /w/ for /r/. In an experimental study, Connell and Parks-Reinick (1982) reported evidence of /w/ for /r/ substitutions that could be discriminated by adults from intended /w/'s, although they were not self-discriminable. Similar findings are reported by Hoffman, Stager & Daniloff (1983).

Second-language acquisition. It has been found that native speakers of Japanese learning English actually produce the 'r/l' distinction better than they perceive it (Dissoyway-Huff, 1981; Sheldon & Strange, 1982). Similarly, it has been found that Arabs learning English produce the 'p/b' distinction better than they perceive it (Connell & Eckman, 1982; Port & Mitleb, 1980).

These studies experimentally examined aspects of production and perception

[5] The details of the perception experiments in this case are sketchy. It is thus unclear whether these differences would be discriminable with a more sensitive test.

PHONOLOGICAL NEUTRALIZATION

and found that there were discriminable production differences that were either not discriminated or that were poorly discriminated by the speakers producing the distinction. The examples from first and second language acquisition and from language change and variation all involve the phonetic implementation of a phonological contrast where no other phonological rule is involved in any obvious way. While no phonological rule may be involved, these production results are not unlike the results associated with putative neutralization rules. These findings thus add another dimension to the relationship between perception and production. The dominant view has always been that perception is as good or better than production; that is, perception leads production. Under this dominant view, production is dependent on perception. There would, therefore, be no expectation of production differences without corresponding perception differences. If for some reason production differences were discovered without the perception differences, those differences would be dismissed as linguistically irrelevant. Because of this bias for the dominance of perception, most research has begun with the assumption that there could not be production differences without perceptual motivation. However, the studies cited above constitute examples of research where the relationship between perception and production is not assumed in advance but rather is empirically determined. While the results of these studies cannot be accounted for by the dominant view, these results cannot be dismissed since the production differences are systematic and discriminable, although not self-discriminable. These results are also important because they reveal that there are many aspects of language change and variation and of first and second language acquisition that require making a distinction between perception and production phenomena. Consequently, since all of the logically possible relationships of perception and production evidently obtain, the new dimension provided by these findings is that perception and production can be at least partially independent of each other. For further support of this point, see Waldman, Singh & Hayden (1978) and Paliwal, Lindsay & Ainsworth (1983).

REANALYSIS OF NEUTRALIZATION

The necessity of distinguishing perceptual phenomena from production phenomena, and the relative independence of the two, has implications for the analysis and characterization of putative neutralizations. Table 2 presents an analysis of phonological neutralization in terms of rules resulting in production distinctions and/or perceptual distinctions. There are four logically possible types of rules given this analysis. Type A cases represent the standard conception of neutralization, namely that the neutralization rule produces outputs that cannot be distinguished either in production or perception. Interestingly, there appear to be no empirically defensible cases of the Type A neutralizations. The review of experimental studies examining putative

neutralizations revealed in every case the existence of systematic production differences corresponding to underlying distinctions. In order for a rule to be denied Type A status, it is sufficient to find either production differences or perceptual differences. All the studies reviewed here involved rules that were denied Type A status because of production differences. The Type A cases are, however, problematic for another reason. That is, they depend on the reasonable certainty that there are no other differences to be found in production and perception. Depending, then, on which phonetic parameters are selected for examination, an instrumental study may show no differences. Given our limited knowledge of all the factors involved in speech perception and production, it is virtually impossible, at least at this point in time, to be sure that there are not some differences present somewhere in the signal that contribute to a production difference.

Type	Production differences	Perceptual differences	Comments and examples
A	No	No	Standard view of neutralization, Not well established, Problematic
B	Yes	No	Limited neutralization. Sound changes in progress. Problematic
C	Yes	Yes	Non-neutralizing, German devoicing
D	No	Yes	Impossible

Table 2

An analysis of phonological neutralization in terms of rules resulting in production distinctions and/or perceptual distinctions

Type B cases would constitute limited neutralizations whereby a rule produces outputs which are acoustically distinct but that are not perceptible by the speaker. This would be an instance of neutralization limited to the perceptual domain – the listener treats two acoustically distinct tokens as perceptually equivalent. The facts of production would not, however, be described by a neutralization rule. Type B cases are actually very similar to

allophonic phenomena in that they involve production differences that are not generally discriminable by native speakers of the language. The difference, of course, is that the different sounds in the Type B cases occur in the same context. In any event, to the extent that sound changes in progress involve rules that are synchronically motivated, Type B cases find empirical support. Many of the other studies reviewed here only examined aspects of production; thus, it is not known whether the production differences were perceptually salient. Consequently, in those cases where the perceptual facts are unknown but a production difference is observed, either a Type B or a Type C (to be discussed) case is evidenced. There is one difficulty with Type B cases. While it is claimed that they involve production differences that are not self-discriminable, it may well be that the perceptual tests were not sensitive enough to reveal perceptual salience. More sensitive measures may result in the reanalysis of Type B cases as Type C.

Type C cases constitute non-neutralization, i.e. rules that produce outputs with phonetic differences corresponding to underlying differences and those differences are self-discriminable. The most interesting research findings supporting Type C cases come from the Port *et al.* and O'Dell *et al.* examination of word-final devoicing in German. Recall that systematic production differences were found corresponding to the underlying voice contrast, even though the rule of word-final devoicing presumably neutralizes the contrast phonetically. These production differences were, moreover, found to be perceptually salient in both studies. Specifically, German listeners performed significantly better than chance in an identification task (72% correct responses in one study and 59% correct in the other).

Type D cases are, of course, unattested and uninteresting due to the impossibility of perceiving differences where none exists.

Given this analysis of neutralization, only one of the four logically possible types is well-established, namely Type C. Type C is, however, the only type that is clearly non-neutralizing in terms of either production or perception. The Type B cases, representing perceptual neutralization, are not especially well-established because of the possible reanalysis as Type C cases. However, even if Type B cases could be established, the standard characterization of neutralization would still have to be modified in order to account for the more limited perceptual neutralization despite non-neutralizing production differences. The standard view of neutralization, Type A, is, unfortunately, without empirical support; and Type D cases are untenable.

THEORETICAL CONSEQUENCES

These results appear to motivate the following biuniqueness conditions:

Every genuine phonological distinction has some phonetic reflex, though not necessarily in the segments which are the seat of the distinction.

Two utterances which are identical phonetically must also be identical phonologically.

These conditions constitute strong empirical claims. They are probably too strong given the available evidence and are thus offered with appropriate cautions. Specifically, all the evidence available on this issue comes from one type of rule only, namely non-assimilatory neutralizations. It remains to be determined whether other types of putative neutralizations are consistent with the above conditions, e.g. assimilatory neutralizations such as nasal assimilation. If future research should find that assimilatory processes do in fact result in phonetic merger, it may still be possible to maintain the above claim restricted to a more limited, but well-defined, class of phenomena including non-assimilatory processes. That is, the only viable neutralizations may be a consequence of assimilations. Biuniqueness would hold in all cases except those where an assimilatory process intervenes. The suggestion, moreover, would be that the appropriate theoretical distinction is between assimilatory and non-assimilatory rules. Within the class of assimilatory rules, a distinction could be made between neutralizing and non-neutralizing rules, since some rules (by Kiparsky's definition) could produce outputs that do not exist at the level of possible inputs.

This reanalysis and the associated biuniqueness conditions have a variety of consequences for phonological theory. One of the consequences is that the construct 'neutralization' (and any principles of grammar formulated in terms of it) may be empirically indefensible. The construct would not, however, have to be completely abandoned if the Type B cases exhibiting perceptual neutralizations could be better established. The establishment of Type B cases would, nonetheless, require a change in the standard characterization of neutralization. Neutralization would, then, be limited to a description of perceptual mergers, independent of the production facts. Such a change acknowledges that grammars are not neutral with respect to speaker and hearer. It suggests either that grammars include and distinguish between production-oriented rules and perception-oriented rules or that grammars are exclusively descriptions of perceptual phenomena. To restrict grammars to perceptual accounts would exclude from the domain of linguistics a tremendous range of facts from language change and variation and from first and second language acquisition. Also, all statements of allophonic variation within a language would have to fall outside the linguistic domain due to the nondiscriminable character of allophones. However, even if grammars

PHONOLOGICAL NEUTRALIZATION

were restricted to perceptual accounts, many of the putative neutralizations, such as German word-final devoicing, would still remain as LINGUISTIC phenomena due to their resultant discriminable differences. These cases would have to be described phonologically, but they would be characterized as non-neutralizing and could no longer serve as supporting examples for any claims about neutralization.

Consequently, since many putative neutralizations, when examined more carefully, may be shown to be non-neutralizing on all accounts, the only viable possibility for the construct NEUTRALIZATION is if phonological theory admits a distinction between perception and production. Such a distinction would allow for Type B cases. The description of Type B cases would include a neutralization rule, although it would be limited to describing the perceptual facts. But, what about the production facts in the Type B cases? To not describe them would exclude from phonology a broad range of linguistic phenomena as discussed above. It should be noted, however, that the production facts from the Type B cases are not unlike the production facts in the independently necessary Type C cases or in the allophonic cases. Given, then, that phonological theory must in any case allow for rules describing substantive details as in the Type C and allophonic cases, there is no necessity whatever to exclude or ignore the description of the production facts in the Type B cases. It must be recognized, however, that the description of production facts will not always coincide with the description of perceptual facts. In fact, Type B cases will require two different rules, one describing the perceptual merger and the other describing the phonetically distinct realizations. Because these descriptions can be different, both a production-based phonology and a perception-based phonology appear to be warranted. It is simply not viable to limit phonological descriptions and theory to accounts of only perception or only production. In addition, accounts which presume to be neutral with respect to speaker and hearer become so abstract as to have no connection with facts in any domain. Our understanding of putative neutralizations benefits from a consideration of both production and perception facts, and has implications for broader issues in phonological theory.

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PHONOLOGICAL NEUTRALIZATION

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