

New Variants and Functional Bases on Sonority Conversion*

Abstract

Although sonority conversion has been assumed to hold true solely for less sonorous /w/ than liquids, it is applied extensively to vowels and other sonorant consonants. As well as the less sonorous tap in AmE, this article posits the case in the standards/varieties of ModE and PDE where the mid central vowel /ʌ/ has the larger value than high peripheral vowels. The three pieces of evidence (stress distribution, sonorant syllabification, sound change) turn out to support my observation. The ordering does not occur in any case that, say, a voiceless/voiced pair becomes opposite. Functionally, all of the possible hierarchies stem from physically rare features according to which the segments of this sort are articulated differently in part from the invariant. The features are classified as (a) the segment-specificity where languages have a similar disposition or as (b) the phenomenon-specificity that affects a ranking within the range of possible articulation.

1. Introduction

Many, not all, of the ModE and PDE phonotactic constraints have in common the vowel /ʌ/ (henceforth otherwise TURNED V, the central stressed vowel, etc.), which is generalized to consist of the two sorts: (1) consistent occurrence among them, highly common usage, no other pronunciation for the majority, Middle English /u/ as the early form, and (2) dialectal, allophonic, no historical antecedent (cf. Wells 1982, Kortman and Schneider 2005, Tillery and Bailey 2005 on the latter; see also Beal 2004b, Wolfram 2008 on ModE, cf. Wells 1982, 1997 on the features of the /ʌ/ vowel itself):

- (1) sun, tun, funny, sunny, enough, struck,
(2) a. NorthernBrE sugar cushion
 [ˈʃʌgə] [ˈkʌʃɪn] (the stressed [ə] alternatively)
 b. ScotlandE comma manner
 [ˈkɒmʌ] [ˈmʌnʌ] (schwa as the predominant form)
 c. AmE South strut
 [strʌt] [strɪt] (copronounced)

It differs from other vowels both in and outside the English language in a few respects. The reason for this observation comes from the intrinsic idea that sonority conversion implies that the ranking of a segment diverges from the universal one. By way of the uncommon status of some features, the sense of the rareness becomes explicit. In comparison with others, the /ʌ/ vowel shares with schwa the articulation as mid central, with /a/ the one as stressed and central. It is more audible than schwa, and less audible than low vowels. TURNED V varies in the points of articulations both crosslinguistically and language-internally. Taking cardinal vowels into consideration, it is represented as the unrounded

counterpart of /ɔ/. This is why the ones illustrated above have a specific articulation. The pronunciations in the PDE dialects are centralized, or slightly more backward, or slightly opener. In the phonetic descriptions (e.g. Dretzke 1998, Roach 2000, Crystal 2003), the third one has the highly common distribution. As far as my knowledge, the rare features on it seem to have been known as one of the peculiarities on English vowels (cf. Crosswhite 2001 on the relevant descriptions).

The research on sonority began to be done prior to the advent of generative linguistics. Since the classical works made by Whitney and Sievers in the late 19th century and by Sweet, Jespersen and Trubetzkoy during the first quarter of the 20th century, the effect sonority has had on phonological issues ranges increasingly over theory, law, entity, phenomena, etc. The widely discussed topics in or related with English phonology are, in particular, shown to be two-fold: (a) Preferences Laws (the diachronic shift of syllable structures), originated in Murray and Vennemann (1983) and updated by themselves and reexamined by, say, Picard (1990), Hall (2004), (b) syllable-edge coronals (Clements 1990, Hall 2002) which are likely to cause the disagreement to occur both in a wide variety of the languages and across theoretical frameworks.

The term ‘sonority conversion’ used herein refers to the specific ranking of the relative loudness in individual language, in comparison with the fixed one applied to the large number, if not all, of the world’s languages. Hankamer and Aissen (1976) observed that the ranking varies between /w/ and liquids and that the labio-velar semivowel has the smaller value. Their supposition has been applied correctly to Sanskrit (Steriade 1982) and to Early West Germanic (Suzuki 1989). The other language-specificity is reflected in the less sonorous tap than the lateral and nasals in American English (Oda 2009):

(3) Sanskrit R, /j/ > /w/ > L

(4) Early West Germanic R > L > /w/

(5) AmE L > N > [r] > VF

The theme I would like to address in the former half of this article is attributed to the relative loudness of TURNED V. The phenomenon on the sonority is posited that the stressed central vowel is set in the higher hierarchy than high peripheral vowels by the degree of one and that this presents the formerly unattested vocalic case on the specific ranking. Although the previous researchers along this line have observed crosslinguistically the limited cases, that is, those between /w/ and liquids, this article views, as well as the less sonorous tap in AmE, the larger value of /ʌ/ as a new kind of evidence.

It is also suggested that some orderings are disallowed to occur in the phonologies of the world’s languages: voiceless obstruents relative to the voiced counterparts, some vowels with certain conditions shared.

Taking into account the previous, the new, and the impossible cases, this article pursues the reason why such specific rankings hold true for some particular cases. It elucidates the functional motivation with regard to the sonority conversion, arguing in favour of the phonetic bases on each of the possible

examples. The applications of them to phonological phenomena have actively been widely discussed in the large number of works. It is assumed that the sonority conversion stems from physically rare features, which are further divided into segment-specific or phenomenon-specific ones.

The present paper is organized in the following way. Section 2 reviews briefly the less sonorous tap in AmE. Section 3 discusses the more sonorous TURNED V with the three sorts of the evidence. Section 4 investigates the individual orderings that languages do not take. Section 5 argues in favor of the phonetic groundings in all of the cases at issue. Section 6 concludes.

2. The AmE tap

Taps and flaps are articulatorily different from each other; the former lack the movement in the latter where the front of the tongue is curled up before it moves toward alveolar ridge (Ladefoged 2006). In AmE, the underlying stops /t, d/ undergo tapping (cf. *better, city, daddy*). The allophonic tap is syllabified to the coda-finals in the intervocalic positions that a liquid or the alveolar nasal may or may not precede (Kahn 1980). For the contemporary correct definition, the prosodic approach (Jensen 2000) requires the higher level to be made use of. It develops prosodic hierarchies into the analyses on the allophonic variants and makes the explicit account for the controversial aspects that the ambisyllabicity can not. The examples illustrated below suggest that the AmE tap affiliates not to the coda-finals, but to the onsets of the unstressed and the stressed syllables each in (6a, b). The employment of a higher hierarchy in such examples (foot, prosodic word, phonological phrase, etc.) should be necessary:

(6) a. go [r]o Europe b. po[^hr]ato

Research on rhotics has been widespread in English phonology and phonetics. On AmE rhotics, de Jong (1998, 2011), Patterson and Connine (2001), Gick (2002), Riehl (2003), Britton (2007), HALL (2009) and Campbell et al. (2010) are involved in the contemporary literature. The rhotics derived from /t/ occur also in some accents in England (Beal 2004a, Honeybone 2006, Broadbent 2008) and in Australian English (Tollfree 2001, Evans and Watson 2002). See Connell (1995) on the articulation of rhotics and McMahon (1996, 2009) on those in the history of English. As a basic feature outside linguistic analyses, it holds true for AmE that the tap sounds rather like a stop and that it is audibly between other rhotics and stops. This implicitly demonstrates the partial predictability of the less sonorous tap.

Making the assumption on the individual ranking of this rhotic, we can take a contrary view to the previous works on the conversion between /w/ and liquids. The less sonorous /w/ varies in degrees. The one of the AmE tap constitutes a new type:

(7) R > /w/ > L or R > L > /w/

(8) L > N > [r]

Phonologically, the tap derived from the underlying /t/ or /d/ makes a clear contrast with the central approximant of /r/ derived from schwa (/t, d/ → R, /ə/ → R): the consonant lenition vs. the vocalic weakening, the derivational directions in terms of the sonority, the status of the underlying segments, etc. It is a simple, but rather natural assumption that the former rhotic has the smaller value than the latter.

Compare, next, the tap with alveolar stops in phonetic terms. The difference between them is attributed to the time to make a contact of the tip of the tongue with alveolar ridge: in general, short contact for the tap and long one for the stops. Among the English allophones, clear vs. dark 'r' has a gradient articulation, i.e., postured in a certain position between the two (Sproat and Fujimura 1993). The postures on the tongue body vary in several degrees. The reason for it comes from the human apparatus to facilitate them. Taps conform to the gradient postures. In the general view, alveolar stops are made with a firm contact with alveolar ridge and taps with a quick contact with it. It is logically possible that the AmE tap has the time of the contact between the quick and the firm ones.

The following paragraphs adduce the pieces of evidence on the less sonorous tap. In terms of the syllabicity of consonants, high sonority scales are equivalent to the status of nuclei. In comparison with the central approximant, the tap does not take the slot of nuclei. Due to the hyper-rhoticity that leads to the stressed syllabic consonant and the second elements of the diphthong, the rhotics that affiliate to the syllabic nuclei should be common, but it is not the case for the tap in the stressed and unstressed syllables:

- (9) a. Heard b. your c. better d. creativity
 [hɜːd] [jɹ] *['bɜːr] *[vɜːi]

The lack of the syllabic status has also a clear-cut distribution when related with the lateral and nasals (e.g. litt[l̩], eat[n̩], at[m̩], thick[ŋ̩]). In sum, the central approximant of /r/, the lateral and the three nasals affiliate to the nuclei. The /r/ occupies the nuclei in both the stressed and unstressed syllables, and the others only in the unstressed syllables. The sonority and the syllabicity correspond with each other. This implicitly shows the less sonorous tap.

The tap occurs frequently as a singleton (*city, water*). The allophonic rhotic does not constitute a sequence with heterosyllabic onset, but the syllabic consonants may follow (see the examples in the last paragraph). When cooccurring as a coda cluster, it is preceded by a rhotic, the lateral and the alveolar nasal:

- (10) a. Party b. guilty c. Kentish

Assuming that the tap is less sonorous than nasals by the degree of one, the sonority contours on SonC + tap are regarded as reasonable outcomes, partly because this ranking demonstrates the satisfaction of the contours without any violation, which play an effective role in the tautosyllabicity. The following two similar cases underpin the present argument. First, according to Treiman and Zukowski (1990), the

/dr/ in the word *Madrid* serves as the onset cluster ([mə¹drɪd]), but the /st/ in *estate* is heterosyllabified ([ɪs¹tɛɪt]). This is attributed to the preference of the onset clusters in terms of the sonority profiles. Second, in the similar vein, the coda phonemes are tautosyllabified more commonly in the /lp/ (*helper*) than in /ŋkθ/ (*strength*).

In words with a vowel and a syllabic sonorant, the intervening consonant must be, in accordance with the generalized principle, less sonorous than both of the nuclei. Based on the form that the syllabic consonants, instead of the one with schwa, surface, in the words *even*, *final*, the consonants (*v*, *n*) have the smaller value than the following nuclei (*n*, *l*) by the degree of one, respectively. By contrast, in *sullen*, *laurel*, the word-finals where the sonorant syllabification is blocked from occurring (cf. Wells 2000), the preceding consonants (*l*, *r*) are higher than, unless not undergoing the formation, the syllabic sonorants (*n*, *l*) by the sonority ranking of the minimal distance. It is not the case, however, and the form with schwa surfaces. The pronunciations tap plus syllabic lateral or alveolar nasal have been repeatedly illustrated in the literature (Kahn 1980, Wells 1995, Jensen 2000):

- (11) a. little b. bottle c. atom d. bottom

The ranking I posit ($L > N > r$) implies the less sonorous [r] than [l] and [m] with the distance of two or one. This means that each of the sonority profiles conforms to the generalization of the nuclei and the margins and that the internal ordering makes sense.

The converse view is to suggest that the tap has the higher hierarchy than any obstruents. First, on account of the Syllable Contact Law, larger value on the preceding syllable-final and smaller value on the following syllable-initial form the better syllable contacts (Ham 1998, Murray 2000 and others). The coda tap is adjacent to the four sorts of the segments across the syllable boundary:

- (12) a. daddy b. beater c. little d. atom
 [¹dæɪ.i] [¹bɪɪ.r.r] [¹lɪɪ.l] [¹æɪ.m]

In the assumption of the language-specific ordering made by the author of this article (i.e. $R > L > N > r > VF$), the lefthand example occupies the maximum difference at the degree of seven and the righthand one the minimal distance of one. The coda taps illustrated above demonstrate the sonority contours where the syllable contacts are violated in the different degrees. Turn to examine the other cases on the more sonorous following initials:

- (13) a. erudite b. topmost c. footlight d. aqua
 [r.j] [p.m] [ʔ.l] [k.w]

Each of them has the larger sonority degrees by the distance of one, four, five and seven. The seven degrees are considered to be the biggest difference. Those with the eight degrees are represented as

voiceless fricative – mid central vowel and as nasal – low vowel, but such cases do not occur. It occurs, if any, when the coda maximization, as the explanatory theory, takes precedence on the ambisyllabicity and when the following syllable begins with a high peripheral vowel (*thinking*). In the example in (12a-d), unless the tap has the lower value than voiced fricative that leads to the illicit eight degrees, the syllable contact conforms to that of AmE.

3. The vocalic conversion

It is the working hypothesis that the /ʌ/ vowel, classified as a mid central regarding the articulation, is higher than high peripheral vowels on the sonority and that this constitutes the formerly unattested case on the sonority conversion. The features on TURNED V were shown in section 1. Relative to the AmE rhotics, the literature on the stressed central vowel has been sparse. Although Wells (1982, 1997) illustrates the features and the variations on it, his descriptions are not in detail. To my thinking, the ideas phonologists may possibly share on it in uncontroversial sense consist of (a) difference from schwa in terms of the articulatory energy and (b) difference from low vowels in terms of perceptual ambiguity or clearness.

Touch now on addressing the licit way on how to adduce the pieces of evidence on this issue. To put it in three ways, they are obliged to be based on phenomena (a) accounted for by sonority, (b) discussed in the frameworks of, for the most part, crosslinguistically examined issues and (c) observed in the level of the individual languages with minor differences of surface and nonderived forms.

The restriction in (a) is a matter of fact. The sonority conversion can be accounted for by sonority-based phenomena, but not by features, perception, articulation, etc. The one in (b) consists of a wide variety: the Syllable Contact Law (distance of sonority across syllable boundary), lip-opening on vowels (wide or narrow in a single hierarchy on vowels), historical direction (shift to more or less sonorous one on a phonological process), etc. All of these operate crosslinguistically and can present the language-particular features illustrating the differences from those of other languages. The aspect stated in (c) plays an integral factor in the phonology addressing the language-internal ranking. To be addressed on this is that a certain allophone surfaces in some cases, but not in others, or that vowels with or without stress lead to the different direction on contemporary shifts, etc.

3.1. Distribution of Stress

The majority of the dialects in ModE and PDE have a consistent stability on the sonority-based distribution of stressed/unstressed vowels. For short vowels other than /ʌ/, low and mid peripheral vowels are stressed, high peripheral vowels are both stressed and unstressed, and mid and high central vowels are unstressed. The exception to this is represented as, say, the dialect in Northern England where the stressed schwa occurs (cf. Wells 1982, Ex. 2a in section 1.).

Theoretically, contrary to the Prince's (1997, based on the de Lacy's 2004 citation) fixed theory of markedness, de Lacy (2004) posits the conflation of the rankings. The former has the one where the hierarchy remains consistent; in the five scales on vowels, for instance, high peripheral vowels are

always higher than mid peripheral vowels. This has some exceptions, however. In the latter, adjacent hierarchies behave like a single category and some languages have the same behavior of both of the vowels with regard to the placement of stress. Compare at this point the vocalic ranking I posit on this issue with the one on the basis of the invariant:

- (14) a. LV > MPV > TURNED V > HPV > MCV > HCV
b. * LV > MPV > HPV > TURNED V, MCV > HCV

The assumably correct ranking in (14a) has the distribution of the stress for the upper three, of no stress for the lower two, and of both of them for HPV. Making the illicit ranking that TURNED V is set equally to MCV, the sonority-based stress placement gives rise to the category that MCV is tantamount not to HCV, but to HPV in the sense that both TURNED V plus MCV and HPV are both stressed and unstressed. Given this, it might be questioned whether the two categories the two vowels with or without stress and the one stressed and the one unstressed vowels are classified as same or different hierarchy. On the condition of the single sonority hierarchy, to my thinking, the unitary affiliation makes sense. In a language where the vowel /ɪ/ is always stressed, but the tense counterpart /i/ is always unstressed, unless the sonority ranking varies, it is not the case in point that both of the high front vowels are differentiated in the hierarchy. By way of comparison, both of the hierarchies (14a, b) conform to the conflated theory on markedness made by de Lacy.

The validity in (14a) is, however, not accounted for by the theory on sonority, but by the distribution of the stress placement in the polysyllabic words, as shown below. The argument made by the de Lacy's article is obtainable in a different fashion; on the occurrences in the stressed syllables, TURNED V takes precedence on high peripheral vowels. The relationship between the sonority and the stress is reflected in the distribution with the /ʌ/ and the unstressed /i/ in the disyllabic words:

- (15) Enough, funny, sunny, monkey, country

The issue addressed at this point is attributed to the ranking of the sonority on the basis of /ʌ/, /ɪ/, and /ʊ/ in the stressed syllables relative to the unstressed high front /i/ vowel in the same words. The minor differences lead to a piece of evidence in this line of research. Observe the cases in which the stressed vowels are occupied by the high back and front vowels, each in (16) and (17):

- (16) woman, cushion, bullet

- (17) city, busy, pity

In the case of the stressed /ʊ/, the unstressed vocoids vary: from the lefthand, schwa, syllabic [n], and [ɪ]. The last one surfaces also as schwa (Wells 2000). The syllabic [n] preceded by the /ʃ/ might be very possibly an obligatory phonetic implementation. On the next example, the final vowel shifted from

the /ɪ/ to the /i/ during Early Modern periods (Windsor Lewis 1990, Beal 2000). After the tensing process took place, the sonority-based distinction between the two syllables was shaped since the derived unstressed vowel is less sonorous than the other.

Between the two high lax vowels, the less sonorous one corresponds to the back vowel, which does not cooccur with the /i/ in many of the cases, but with the schwa and the syllabic consonants. The established sonority contours are reflected in the cooccurrences. The /ɪ/ vowel more commonly co-occur with the /i/ vowel. The higher frequency is manifested in the words such as *city*, *busy*. For the /ʌ/ vowel, it is true that the cooccurrence of the /i/ is most common. (See the lists of the words exemplified in Wells 1982:132, Gimson and Cruttenden 1994:104.) The supposition derived from this sonority-based vowel distributions is the generalization that if a stressed vowel more frequently co-occur with the /i/ vowel, it has more possibility to have the larger sonority value. The stressed central vowel is therefore higher than high peripheral vowels.

3.2. Syllabic consonant formation

Both ModE and PDE have the phonological process of the sonorant syllabification by way of the deletion of schwa (cf. the word-finals of *tunnel* and *happen*). Syllabic consonants may or may not occur on the basis of certain conditionings. On the basis of speaking tempo, fast speech makes the syllabic formation more, but slow speech by contrast makes the form with schwa more; the possible ones consist of the words where the two forms co-occur, as in *final*, *thicken*. The syllabic positions (pretonic, posttonic or stressed) are included in the criteria in the sense that posttonic syllables more readily undergo the process and that AmE syllabic [r] is typically stressed among all of the accents. (See Roach, Sergeant and Miller 1992, Wells 1995, Toft 2002 on some of the conditionings.) The conditionings of derivation, under which the deletion of a vowel and the compensatory syllabic formation are implied to proceed, make the two periods differ radically from each other. The former period has solely the underlying schwa with the exception extremely limited. In the latter, the variability on the underlying vowels sharply increases. Stressed vowels as the underlying status are concerned with the argument made at this point since we must examine the issue of the underlying /ʌ/ of stressed syllabic consonants. The following exemplify the syllabic consonant formation when the underlying forms are represented as the ones with the vowels mid central (18a), high peripheral (18b), and TURNED V (18c). Due to the examples that evidence the stressed syllabic consonant formation, I adopt those in AmE in this analysis. Many, but not all, of the following examples are cited from Hammond (1999):

- (18) a. heard, bird, purse, surf, curt, firm, curl
- b. your, poor, bull
- c. mull

The underlying vowels are represented most commonly as /ɜ:/, and partially as the other two. I assume

that the ones in (18b) take precedence on the one in (18c) with respect to the frequency of the occurrences. First, the /u/ is closer to the central approximant of /r/ on the shapes of the tongue. The reason for it comes from the raising of the back. When the syllabic consonants are implemented, listeners can perceive each of the words without any difficulty. In this sense, the back vowel makes a contrast with /i/ and /ʌ/. Second, the words *your* and *poor* are used in daily lives. Third, as far as I can see, there is no example other than *mull* on the one as a result of the deletion of TURNED V.

The issue of whether or not the underlying vowels are deleted, in either the syllabic consonant formation or vowel loss in a certain way, is explicitly accounted for by the ranking of the sonority. Vowel loss and sonorant syllabification in general share the phonological process of the deletion of schwa, which is the least sonorous among the vowels in many languages. In enough contrast, low and mid peripheral vowels do not serve as the deleted vowel in any case in any period of English.

As demonstrated above, the sonorant syllabification takes place by way of the deleted /u/ more commonly than the deleted /ʌ/. The deletion of the vowels features low sonority on them. AmE is not included in the exception. The syllabic consonant formations occur more commonly as the deletion of the less sonorous vowels. The other process vowel loss is usually that of schwa. This leads me to argue for the more sonorous TURNED V relative to high peripheral vowels.

3.3. Sound Change

3.3.1. Sonority promotion

The /ʌ/ vowel began to occur around the end of ME and shifted from Early ME /u/. Since Early ModE, it became the standard pronunciation in the words such as *enough*, *sunny*, *come*. In the general view, the shift of vowels from ME to early ModE clearly reflects in the phonology the sonority promotion in stressed syllables and the sonority demotion in unstressed syllables. The clear-cut distribution on the basis of sonority was established throughout the periods. This is regarded as one sort of the change from worse to better in the sense of Preference Laws (Vennemann 1988, see also Vennemann 1983, Murray and Vennemann 1983, Murray 2000). The preference to the vowel such as TURNED V is referred to as the Nucleus Law (Vennemann 1988:27), but it does not state that of sonority scale. It is definitely clear, though, that the shifts like those in the periods conform to the basic ideas on the preference to the sonority. There are dialectal differences and the shift is not uniform. As the general tendencies, however, it became predominant that low and mid peripheral vowels occupy stressed ones, while mid central vowels unstressed ones.

Since the focus made at this point is the sonority scale of TURNED V, short stressed vowels should be dealt with. The sound changes for them were not so thorough as those for the Great Vowel Shift (cf. Stockwell 2002 as one of the models). Overall, it is the case in point that the three periods early and late ME and early ModE each partially improved on the stress-related sonority. In early ModE, some of the /u/ vowels shifted to TURNED V, as illustrated in the following:

(19) Come, judge, supper, onion, love

(20) enough, other, rough, month

Prior to the formation of the ModE /ʌ/, the ME equivalents to (19) and (20) were the lax and the tense forms of high back vowel, respectively. The earlier counterparts are always occupied by the stressed vowels without any exception. The unstressed high back vowels themselves were much less common in ME. This paper assumes that the /ʌ/ vowel formation in early ModE can be accounted for by the sonority promotion that implicitly specifies that TURNED V has the higher sonority than high peripheral. In the same period, new stressed short vowel formations were relevant to the sonority promotion.

(21) a. /ɔ/ → [a] dog, body, college

b. /a/ → /æ/ cat, fact, black

(22) /o:/ → /u:/ cool, move, fool

In (21a, b), each sound change has the aspects of the promotion, and the stability. The short vowels do not undergo the demotion, which is true for some of the long vowels, as in (22). By way of the sonority system, the formation of the /ʌ/ vowel therefore results from the promotion or stability of the sonority in comparison with a high peripheral vowel, /u/.

Compare next the newly formed TURNED V with the unstressed vowel in the disyllabic words. A certain feature emerges from them:

(23) a. money b. worry

(24) enough,

In (23a, b), the stressed vowels shifted from the /u/ to TURNED V and in (24), prior to the /ʌ/ formation, the /u:/ vowel was pronounced. In all of them, the unstressed syllables have the /ɪ/. In the words such as *money*, *worry*, the tense counterpart surfaces in the word-finals, but the /ɪ/ still remained to occur in the period at issue. According to Windsor Lewis (1990), this tensing originates in Modern period. In the similar vein, Beal (2000) takes a closer examination on that in Northern England. The high back vowels in (23, 24) are, prior to the newly formed /ʌ/ vowel, equal to each of the other high front vowels. In the level of the individual vowels, the high back is less sonorous than the high front. I claim that this sound change is grounded in the sonority contour where the stressed vowels should be highly valued than the unstressed vowels. In the examples such as (23, 24), the ME forms have the stressed high back vowel and the unstressed high front vowel. The stressed vowel has therefore the same hierarchy as, and, in the level of each segment, lower than, the other. After the new vowel formation took place, the /ʌ/ as being more sonorous than high peripheral vowels by the degree of one constitutes the stressed vowel whose sonority scale is higher than all of unstressed vowels.

Early ModE established the phonological system that in polysyllabic words, the sonority on stressed vowels is higher than that on unstressed vowels. During the ME periods, the equality of the sonority has a minor, but, in the two opposing ways, neither common nor no, distribution. The following cases are involved in the equal ranking of the two vowels:

(25) city, pity

(26) a. /tʊ/ tiwesdai ‘Tuesday’

b. /ʊ/ juinen ‘join’

The /i/ vowels in both of the syllables shift to the better one in Early (or Late) ModE due to the tensing in the word-final positions. In the level of each segment, the tense /i/ has the smaller value than the other. That is why the better sonority contours are formed on the basis of the sonority. By way of observing the slightly different one unseparable two elements, the two diphthongs exemplified above each consist of the two elements as the high peripheral vocoids. Both of them disappeared in Early ModE with the dates and the later forms inconsistent among dialects.

3.3.2. Contemporary case

In a dialect of BrE, the underlying /ʊ/ may or may not surface as the /ʌ/ vowel, as shown in those in (2a). This allophone implicitly illustrates that the same shift as the ME sound change that created the new phoneme /ʌ/ recursively takes place in the contemporary dialect. Alongside this line, see McMahan (1990) in view of the phonological theory, Beal (2007) with regard to the language-internal analysis. It has commonly been repeatedly argued that speakers in a Present-Day language have the phonological knowledge on the corresponding Modern periods (cf. Chomsky and Halle 1968 on the earlier discussion). The allophonic [ʌ] in Northern England is like this in the sense of the history of BrE, but unlike this in the sense of the one in the specific dialect.

Wells (1982:353) observes that this northern shift owes to hypercorrection, which results from employing the person’s own accent in those with the underlying /ʊ/, as in *sugar*, *butcher* and *cushion*. The sonority-based argument is applied to this contemporary shift. In the dialects of PDE as well as those of ModE, differently from the earlier counterparts, higher rankings on the sonority of the vowels are correlated with stress placement. This leads me to claim that it is the natural direction that the distributional relationship of the stressed vowels with the larger sonority values bases the allophonicization like the one in northern dialect on the sonority promotion. The direction of the more sonorous stressed vowels remains to be consistent and the /ʌ/ vowel has the larger value than high peripheral vowels.

4. Prohibited conversion

4.1. Voiceless and voiced obstruents

There is no case of the sonority conversion in which voiceless stops and voiceless fricatives have

the larger value than each of the voiced counterparts. The difference between the pair of the sounds is attributed to the articulation made by breath or voice. The latter accompanies the vibration of vocal folds and the former does not. With the state of the activity on the voicing, a certain voiced obstruent has the higher sonority scale than the voiceless one, but not vice versa.

Final neutralization as one of the fields in laryngeal phonology (cf. Avery and Idsardi 2001, Honeybone 2005, Iverson and Salmons 2003, 2007, Jensen and Jensen 2005) refers to the term that specifies that the underlying form with either of [\pm voice] surfaces as both of them: [+voice] \rightarrow [-voice], [+voice] or [-voice] \rightarrow [-voice], [+voice]. In the first one of these schemata, the underlying voiced form may surface as the voiceless one; given the underlying final *-nd*, for example, the stop devoices and the surface form *-nt* replaces it. Conversely, the second one is implied to the emergent voiced obstruent, which is likely to take place by way of final derivational vowel; in the abstract form with final *-nt*, the attachment of the suffix *-y* to it leads to the obstruent voicing. Instead of either of them, both of the forms alternatively occur in the final environments. This is referred to as final neutralization.

The final devoicing has been assumed to be the assimilatory process to ‘silence’ following the obstruent (Hock 1999). In this context, the ‘silence’ is considered to be either the end of utterance or pause between the two sentences. Consider now the following two cases; the underlying voiced obstruent is followed by the word with initial vowel or speakers make a quick speech; in the same way, it is followed by consonant-initial word or speakers make a slight pause. I observe that this might depend on languages, but quick speech or pause has more possibility on the final devoicing. Word-medially, the effect made by the following segments is more important. Taken from a crosslinguistically common one, the sequence nasal + stop is homogeneous on the points of articulation. The devoicing is, if any, grounded in the assimilation. Due to the strings of the medial segments, there is no effect where the so-called silence leads to the lack of the voice. Oppositely, the word-final obstruents are assumed to undergo the effect of the pause. The longer the time for the silence, the more the occurrence on the final devoicing. In this sense, the silence that has an effect on it makes sense, though specific observations might be necessary in some languages. Assuming the assimilation to the silence, it is definitely clear that the shift to the voiceless sound is implied to be the one to the less sonorous sound.

The final voicing must be examined on what functionally motivates the shift. The two possibilities arise on it: consonant lenition or assimilation to vowel. The former is meant to be the process whereby certain consonants become phonetically weaker in terms of either reduction of effort (Kirchner 2004) or reduction to obstruct air flow (Kingston 2007). The crosslinguistic tendencies are taken into account that consonants become weaker intervocally and that the strength on each of the vocalic sounds more readily causes the lenition to occur (Kirchner 2004). The process to weaken consonants, however, depends on each example in each language; whether or not the process of a lenition occurs has the gradient aspect (i.e. obligatory, near obligatory, slightly conditioned, and largely conditioned). Overall, consonant lenition is constrained in several respects.

By contrast, assimilation might be possibly binary. It is a reasonable outcome that the

assimilatory process takes place on a phonological environment in every case. The final voicing accords with it. Given the case in which the attachment of the derivational *-y* to the stem *-nt* gives rise to *-ndy*, this voicing is possibly binary; if the derivational vowel is attached to the stem, the voicing always occurs; without any vowel, no voicing occurs in any case. Making a comparison with the consonant lenition, the assimilation can better account for the voicing.

The argument I would like to make in this section is attributed to the issue of the phonological directions. The devoicing is grounded in the assimilation to the silence and the voicing in the one to the vowel. Both of the processes demonstrate the clear-cut distribution that while the devoicing leads to the less sonorous effect, the voicing to the more sonorous one. This means the sonority that a voiced obstruent is always higher than the corresponding voiceless one. The obstruents therefore have the fixed sonority ranking that the voiced/voiceless pairs do not become opposite.

4.2. Vowels with/without stress

Sonority scales on vowels are in part affected by lack or placement of stress. Languages differ in terms of the distribution of stress. The invariant on the ranking of the sonority is shown in the case in which certain adjacent two hierarchies are consistent with each other with respect to stress. Possible candidates contain high and mid central vowels definitely in unstressed syllables and the counterpart with stress on mid peripheral and low vowels. Let us take as the example /ɪ/ and /e/ both of which occur only in stressed syllables. Each of them belongs to high and mid peripheral vowels. The difference of the articulations owes to that of lip-opening. Other aspects might have minor differences, but it contributes to the largest effect.

The higher degree of the opening for the /e/ vowel is implied to venting more air flow from oral cavity to the outside. Lips are opener when speakers articulate it. The sonority, or to put it differently, the loudness is an abstract entity in phonological theory, but not the issue of phonetic details involving sequential effect, and posture of the tongue in the analyses. In this context, sequential effect means, for instance, that the AmE tap is followed by [m] (atom) and by [l] (little). After speakers produced it, lips are closed on the former and almost stable on the latter. If the two syllabic consonants make the difference on the loudness of the preceding rhotic, the phonetic account makes sense. This sort of analytical way is interesting for phonologists and creative for theorists, but useless in contemporary theory. One of the core ideas in phonological analysis comes from the fixed view that, all else being consistent, a vocoid has a higher ranking than the other, when both of them are consistent with each other with respect to stress. With other conditions equivalent to each other, more loudness is conveyed on the vowel with the more lip-opening.

5. The functional basis

5.1. Overview

Looking back on the research history on functional phonology, the advent of Optimality Theory shifted the trend from phonological to phonetic bases. It seems that the functional phonology has

thereafter been continuously discussed in several respects. The ways of the argument along this line vary in each work, but the core of the discussions is that some of the phonological conditionings are replaced by the phonetic ones or that unknown theory and unsettled issue are better exploited by the contemporary physical basis. The functional phonology specifies that phonological entities, markedness constraints, language-internal phenomena or other, are accounted for by either physical or abstract basis; consonant lenition (f – v, t – R, etc.) by reducing the effort of articulation (Kirchner 2004) or by reducing the obstruction of air flow (Kingston 2007), but not by sonority promotion; it is paradoxically true that the phonological conditioning that stressed vowels are more sonorous than or equally sonorous to unstressed vowels (de Lacy 2004), instead of a phonetic one, is attributed to the distribution of stress.

In 1995 onwards, phonetic accounts have been applied largely to the discussions other than constraints and phenomena: syllabification (Gordon 2002), Dispersion Theory (Flemming 2004), Evolutionary Phonology (Blevins 2004 and the subsequent works), bidirectional grammar (Boersma 2007), accidental and systematic gaps (Oda 2011), Licensing by Cue (Steriade 1997), sound change from the view of perception (Hamann 2009) and sonority scale (Clements 2009, see also Vaux 2009). Building on the application of the contemporary predominant phonetics bases to the phonological issues, this article argues in favor of the one of physically rare features to the sonority conversion.

The functional aspect discussed at this point differs intrinsically from that of sonority scale, in spite of the shared discussion on the rankings of the loudness. The latter implies, in highly general terms, the one of, say, R > L > N: the argument on the segments themselves. The general, crosslinguistic features on each category should be examined. The specific hierarchies in individual languages refer to the fact that certain segments become more or less sonorous in the sense of the divergence from the invariant: that of the specific rankings in each example. Narrow examinations should be made on the basis of the limited examples on both the languages and the segments.

5.2. Physically rare features

As have been demonstrated up to section 3, the sonority conversion is represented as the less sonorous /w/ rather commonly and as the tap and the central vowel in the standards/ varieties of ModE and PDE. Behind these conversions and the assumably impossible ones, this author posits, as the conditioning, physically rare features, which are not employed as the technical term in the previous research, but seem to be conceived as one of the shared ideas in the research on sound patterns. The idea of ‘physically rare’ is obtainable by way of speech organs and common or different ways of articulation.

Let us now illustrate what the physically rare features refer to. Consider the two cases of section 4 in which the sonority conversion does not take place. The ranking does not occur that the sonority of voiceless obstruents is higher than that of the corresponding voiced ones. From the physical perspective, given /s, z/, all of the other conditions being consistent with each other, the crucial difference between them stems from the fact that air flow is vented outside by way of either breath or

voice. This activity holds true not only for the alveolar fricatives, but for all or the majority of the obstruents, dependently on phonemic inventories. The invariant rankings between them are, therefore, caused by physically common features. Exceeding them by far, the distinction between breath and voice is intrinsically indispensable on the phonologies of the world's languages. Provided that the sole difference on movement and posture comes from it, it is regarded as a reasonable outcome that a voiceless obstruent does not receive the higher ranking than the voiced counterpart.

Another invariant adduces the same line of evidence: with the distribution of stress consistent, the ranking of the vocalic sonority being adjacent to each other, say, /ɪ/ vs. /ə/ or /æ/ vs. /e/. The two vowels have some features in common, but differ in terms of lip-opening. Between the /æ/ and the /e/ where both of the front vowels are definitely stressed, the former is articulated with the lip-opening more. Sonority in itself refers to the relative loudness of sounds when all other conditions remain equal. The wider opening on the lips is implied to venting more airstream outside them. The case of /ɪ/ and /ə/ with no stress placement is tantamount to the case shown above. If both of them are unstressed, the schwa has always the larger sonority value and the sonority conversion does not take place in the phonology. This posture conforms to a physically common feature since many sorts of the vowels share this account.

Let us now move onto the account for physically rare features that cause the sonority conversion to occur from the perspective of functional phonology. As shown in section 1, the less sonorous /w/ than rhotic, lateral was posited first in Hankamer and Aissen (1976) and exemplified in Steriade (1982) for Sanskrit and in Suzuki (1989) for Early West Germanic. I predict that some other languages have this sort of ranking, in particular when a language has highly commonly onset /w/ and undergoes the process of consonant strengthening in onsets. The semivowel /w/ has double points of articulation: labio-velar. The majority of the consonants are articulated with a single point of articulation: interdental for /f, v/, labial for /p, b/, velar for /ŋ/, etc.; speakers employ the one articulator in each of them. The difference between the single and the double articulations is attributed to the common allophonic shift on the latter. The difficult articulation takes a repair strategy in order to make speakers facilitate it. As Hall (2000) argues, taking one example, palatalized rhotics have crosslinguistically an articulatory incompatibility owing to concave plus convex for the posture and tip plus blade for the point of articulation. This marked, double articulation undergoes a few ways of the repair strategy.

The case of the *[rʲ] is implied to be the difficulty and the other forms might surface. That of /w/ is analyzed in a different fashion. The coarticulated labio-velar readily renders relatively possible the sound that makes the constriction to produce a fricative-like sound owing to the narrower passage inside oral cavity. The devoiced sound of /w/ is phonetically represented as a fricative (Ball and Rahilly 1999). The back of the tongue, rather than the lips, produces turbulent air flow. In terms of the obstruction of air flow (i.e. phonetic view), other sonorant consonants are not described as obstruents in any respect. This paper assumes that the less sonorous /w/ is ascribed to the physically rare feature in the sense that the articulation of /w/ readily gives rise to the sound of the obstruent.

Turning to the AmE tap, physically rare features are manifested in contact of the tongue. Taps

and stops make a contrast with each other with regard to the duration. The former, not in the specific dialect, but as a crosslinguistically common articulation, make a quick contact with alveolar ridge. The latter takes a different articulation in the sense of a firm contact with it. The AmE tap has the duration between the quick and firm contacts. The rhotic as an allophone is derived from underlying /t, d/. The same allophonic occurrence, that is, /t/ to [r], features some of the BrEs, in particular, those of Mid and North of England. According to Wells (1982), Broadbent (2008), the derived rhotic is articulated as the central approximant. Between the underlying alveolar stop and this sort of rhotic, there is no middle-levelled articulation. In contrast to the firm contact of the tip of the tongue with alveolar ridge, the articulation on the central approximant of /r/ is made at palate-alveolar with the front of the tongue curled up. The clear contrast between the stop-derived rhotics in AmE and BrE leads to the fact that the former accent makes the rare pronunciation possible, although the latter does not. It is the case in point in articulatory phonetics that consonants differ in terms of the duration and that the differences of the long or short reflect the strong or weak articulation in them. The AmE tap has the physically rare feature on the specific duration. This has an effect on the less sonorous value.

The more sonorous /ʌ/ vowel is definitely stressed except the one spoken in Scotland, as in (2b), which is implied to be the unstressed /ʌ/ with the smaller sonority than the stressed vowel. The always stressed central vowel is much less common. The articulation on TURNED V is most commonly described as opener than other mid central vowels. Both of the features stress placement in the majority and opener lips play an effective role in the sonority promotion. The physically rare feature on this comes from the more lip-opening for the stressed vowel in the weak environment.

5.3. The two features

The physically rare features I have suggested are further divided into the two types: segment-specificity and phenomenon-specificity. It is prerequisite to clarify what these two subcategories are meant to be. In the former, the feature on one of movement, posture, duration, air flow etc., is peculiar to a certain consonant or vowel. The uncommon feature distinguishes the segment from others. It causes the sonority of the segment to become different from its invariant ranking in the strengthening or weakening direction associated with the physical feature. Since the feature of a segment is shared by languages, the sonority conversion which is grounded in a segment-specific physically rare feature may occur in some of them. In the case of phenomenon-based ones, an individual case occurs in each of the examples. One or more factors lead a segment to be ordered specifically. To the extent that human apparatus allows the articulation to be made, the rare features have an effect on the internal ranking. The possible cases contain, to take one, a certain mid-levelled articulation for a segment A in a language between the invariants A and B. This implies that the one for the specific A is motivated by a physically rare feature and that the ranking of the sonority on the segment in the language diverges from the invariant.

The less sonorous /w/ is applied to the case of the segment-specificity. The feature that readily causes the friction to occur is in itself that of the /w/ sound and lacking in the other sonorant consonants.

Following Hankamer and Aissen, Steriade and Suzuki have posited the less sonorous /w/. It is expected that other languages might also have this sort of the internal ranking. In particular, if the onset of stressed syllables undergoes consonant fortition, the fricative sound might be, though dependent on languages, possibly produced. The reason why this conversion commonly occurs stems from the phonetic feature of /w/. That is to say, the less sonorous /w/ in Sanskrit, Early West Germanic and somewhere results neither from a language-internal phenomenon nor from a feature of classic languages. It is attributed to the feature of /w/ as the segment whose posture of the tongue is likely to make a constriction of air flow and produce the less sonorous sound. The articulation causes the less sonorous /w/ than liquids to take place in the phonologies. This is the segment-specificity the present article posits as a functional motivation. The languages with the ranking hold the shared feature.

The other two English-internal cases AmE tap and TURNED V are meant to be phenomenon-specific. Crosslinguistically, for stops, the tip of the tongue makes a firm contact with alveolar and for taps, it makes a quick contact. The physically rare features on the AmE tap are based on the articulation that facilitates the middle level between the firm and the quick contacts (see de Jong 1998 on the observation along this line). The time for contacting with an articulator may or may not be binary and the tip with alveolar is involved in the gradient case. As has been shown in this literature, some dialects in BrE take the allophonic rhotic derived from /t/. The rhotic in them is articulated with the central approximant. I assume that there is no case, in any way, in which physically rare feature leads to the less sonorous /r/-approximant. If this rhotic is phonetically closer to other sound, the highest possibility seems to be schwa, as in the case of AmE in Gick (2002). Regarding the t-to-r allophonic occurrence, both of the dialects have in common alveolar ridge on the point of articulation for the former, but differ from each other on that for the latter: alveolar ridge for the AmE tap and palate-alveolar for the BrE approximant. This renders different the possibility that the sonority conversion takes place with reference to the phonetic details. The case of AmE is thus implied to be phenomenon-specific.

The more sonorous TURNED V is equivalent to the unrounded for of /ɔ/ when we take a look at the diagram of cardinal vowels (e.g. Ladefoged 2006:217). In addition to the use of the vowel, the /ʌ/ itself is most commonly opener than other mid central vowels. Within a single category on the sonority of vowels, an opener vowel is more sonorous than the corresponding closer one. Mid central short vowels, excluding the long ones due to the difference of stress and energy, are predominantly unstressed, but TURNED V is always stressed. To sum up, the vowel at issue should be more sonorous by way of the stress placement with the more lip-opening. This is specific to the phenomenon of ModE and PDE.

6. Conclusion

Contrary to the previous arguments that states that sonority conversion holds only to the less sonorous /w/ than liquids, this article has demonstrated that it is extensively applied to other sonorant consonants and vowels: the less sonorous tap than the lateral and nasals in AmE and the more sonorous

/ʌ/ than high peripheral vowels. Languages delimit the specific rankings since the pair of voiced/voiceless obstruents and vowels with certain conditions shared constitute the cases to which the fixed rankings apply. The sonority conversion stems from physically rare features by way of which speakers' articulation differs in part from that of the invariant. The phonetic conditionings are categorized into (a) the segment-specificity where languages have a similar disposition and (b) the phenomenon-specificity that affects a ranking within the range of possible articulation.

*Earlier Version of this paper was presented at the 1st conference on the International Society for the Linguistics of English, held at University of Freiburg, Germany on October 9, 2008. Comments by the audiences there made it improve in a few respects. Needless to say, any inadequacies are my own.

Footnote

¹ The summary in section 2 is almost consistent with the argument of the original paper. Though some were omitted due to the lack of the space, the linguistic assertion remains to be kept.

² The ongoing allophonic shift from [nr] to the nasalized tap have occurred commonly in the words such as *center*, *winter*.

³ One of the basic ideas on pedagogical sound-spelling relationships comes from the one that after the system of the spellings was established around the 16th century, some of the sounds shifted to others and that this created a sound-spelling uncorrespondence. The sound of TURNED V is most commonly spelled with <u> such as *sun/sunny*, *fun*, etc. This implicitly illustrates the sound-spelling uncorrespondence after the establishment of the fixed spellings.

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